U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-260 963

Air Pollution Abstracts
Volume 5, Number 4
April 1974. 34198-34895

Environmental Protection Agency, Research Triangle Park, N C

Apr 74

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. APABCA- 5-4-1974	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Air Pollution Abstracts Volume 5, No. 4		5. REPORT DATE April 1974
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Air Pollution Technical Information Center Research Triangle Park, North Carolina 27711		10. PROGRAM ELEMENT NO.
		11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Same		13. TYPE OF REPORT AND PERIOD COVERED
		14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This periodical is published to inform air pollution personnel of the Environmental Protection Agency (EPA), and others, of technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given. Translations are cited with their sources whenever possible. The subject fields are as follow: Emission Sources; Control Methods; Measurement Methods; Air Quality Measurements; Atmospheric Interactions; Basic Science and Technology; Effects-Human Health; Effects-Plants and Livestock; Effects-Materials; Economic Aspects; Standards and Criteria; Legal and Administrative; Social Aspects; and General and Miscellaneous. All abstracts are listed under one of the above subject fields. A subject and author index are included. This issue contains abstracts 34198 - 34895.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air pollution Abstracts Information retrieval		13B 5B

18. DISTRIBUTION STATEMENT Unlimited	19. SECURITY CLASS (This Report)	21. NO. OF PAGES 165
	20. SECURITY CLASS (This page)	22. PRICE 6.75

EPA Form 2220-1 (9-73)

PB 260 963

344045

Volume 5, No. 4
April 1974
APABCA-5(4)(1974)
US ISSN 0027-5956

AIR POLLUTION ABSTRACTS

34198-34895

APRIL 1974

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Research Triangle Park, N. C. 27711

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

AIR POLLUTION ABSTRACTS

VOLUME 5, NO. 4 APRIL 1974

Prepared by
Air Pollution Technical Information Center (APTIC)
Research Triangle Park, North Carolina 27711

Subscribers receiving 'Air Pollution Abstracts'
directly from the U. S. Government Printing Office
should address any inquiries regarding issues
subsequent to June 1972 to:

U. S. Government Printing Office, Washington, D. C. 20402

The Administrator of the Environmental Protection Agency has determined that the publication of this periodical is necessary in the transaction of public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through March 31, 1975.

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Personal authors are arranged alphabetically. The names are presented last name first. When the author is a primary author, an asterisk precedes the Abstract Number.

INTRODUCTION

This periodical is intended to inform personnel of the Environmental Protection Agency (EPA), and others who are also professionally interested in air pollution, of selected technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given.

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As another service, abstracts of all of the literature in APTIC (not just in a single issue of this periodical) on any subject related to air pollution will be provided free of charge upon request. APTIC can search information more recent than that in the current issue of this periodical because of the lapse of time entailed by editorial, make-up, and printing work.

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Acknowledgement is given to the Technical Publications Branch, Informational Services Division, Office of Administration, Research Triangle Park, N.C. for the make-up of the cover and for arrangement of printing and distribution.

Feedback from our users, including suggestions of articles, are always welcome.

APTIC Publications

Air Pollution Aspects of Emission Sources: Primary Lead Production - A Bibliography with Abstracts, June 1973, GPO No. EP 4.9:126, $0.65.

Air pollution Aspects of Emission Sources: Primary Copper Production - A Bibliography with Abstracts, June 1973 GPO No. EP 4.9:125, $0.70.

Air Pollution Aspects of Emission Sources: Pulp and Paper Industry - A Bibliography with Abstracts, March 1973, GPO No. EP 4.9:121, $2.35.

Air Pollution Aspects of Emission Sources: Primary Aluminum Production - A Bibliography with Abstracts, June 1973, GPO No. EP 4.9:119, $0.90.

Mercury and Air Pollution: A Bibliography with Abstracts, October 1972, GPO No. EP 4.9:114, $1.25.

Odors and Air Pollution: A Bibliography with Abstracts, October 1972, GPO No. EP 4.9:113, $3.00.

Air Pollution Aspects of Emission Sources: Petroleum Refineries - A Bibliography With Abstracts, July 1972, GPO No. EP 4.9:110, $1.25.

Air Pollution Aspects of Emission Sources: Iron and Steel Mills - A Bibliography With Abstracts, May 1972, GPO No. EP 4.9:107, $1.00.

Air Pollution Aspects of Emission Sources: Boilers - A Bibliography With Abstracts, May 1972, GPO No. EP 4.9:105, $2.00.

Hydrochloric Acid and Air Pollution: An Annotated Bibliography, July 1971, GPO No. EP 4.9:100, $0.55.

Chlorine and Air Pollution: An Annotated Bibliography, July 1971, GPO No. EP 4.9:99, $0.55.

Air Pollution Aspects of Emission Sources: Electric Power Production - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:96, $2.25.

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Air Pollution Aspects of Emission Sources: Sulfuric Acid Manufacturing - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:94, $0.65.

Air Pollution Aspects of Emission Sources: Nitric Acid Manufacturing - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:93, $0.45.

Air Pollution Aspects of Emission Sources: Municipal Incineration - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:92, $1.00.

Photochemical Oxidants and Air Pollution: An Annotated Bibliography (2 Volumes), March 1971, GPO No. EP 4.9:88, $6.25.

Beryllium and Air Pollution: An Annotated Bibliography, February 1971, GPO No. EP 4.9:83, $0.40.

Asbestos and Air Pollution: An Annotated Bibliography, February 1971, GPO No. EP 4.9:82, $0.50.

Municipal Incineration: A Review of Literature, June 1971, GPO No. EP 4.9:79, $1.00.

Hydrocarbons and Air Pollution: An Annotated Bibliography (2 Volumes), October 1970, GPO No. HE 20.1309:75, $5.00.

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RECENT CONTRACT AWARDS

from the

Durham Contract Operations
Contracts Management Division, EPA

Contract No. 68-02-1376, RFP No. Du-74-A160 .... *$30,000*

DEVELOPMENT OF A TRANSPORTATION CONTROL STRATEGY FOR THE PROVIDENCE, RHODE ISLAND AREA TO ATTAIN NATIONAL AMBIENT AIR QUALITY STANDARDS, BY MAY 31, 1975 AND TO MAINTAIN AIR QUALITY THEREAFTER.

GCA Technology Division, Burlington Road, Bedford, Massachussetts 01730

Contract No. 68-02-1275, RFP No. Du-74-B349 .... *$129,064*

PROTOCOL TO CHARACTERIZE GASEOUS EMISSIONS AS A FUNCTION OF FUEL AND ADDITIVE COMPOSITION.

Southwest Research Institute, 8500 Culebra Road, San Antonio, Texas 78284

Contract No. 68-02-0741, Modification No. 2 .... *$74,904*

LABORATORY ANALYSIS OF ACROMETRIC AND RELATED SPECIMENS COLLECTED THROUGHOUT THE CHESS NETWORK.

Ryckman, Edgerley, Tomlinson & Associates, 12161 Lackland Boulevard, St. Louis, Missouri 63141

Contract No. 68-02-1380, Task Order 0 1 .... *$25,000*

COMPLIANCE INFORMATION DEVELOPMENT AND SOURCE INVENTORY PREPARATION ASSISTANCE FOR EPA REGION VII.

Engineering Sciences, Inc., 7903 Westpark Drive, McLean, Virginia 22101

Contract No. 68-02-1322, RFP No. Du-74-A128 .... *$60,816*

QUICK REACTION ENGINEERING AND TECHNICAL SERVICES.

Catalytics, Inc., 4601 Park Road, P. O. Box 11402, Charlotte, N. C. 38309

Contract No. 68-02-1322, Modification No. 3 .... *$60,816*

QUICK REACTION ENGINEERING AND TECHNICAL SERVICES.

Catalytic, Inc., 4601 Park Road, P. O. Box 11402, Charlotte, N. C. 38309

Contract No. 68-02-1278, RFP No. Du-74-B373 .... *$151,151*

THE PHYSICAL CHEMICAL BEHAVIOR AND RESPIRATORY EFFECTS OF OXIDES OF SULFUR-AEROSOL MIXTURES.

University of Washington, Seattle, Washington 98195

Contract No. 68-02-0577, Modification No. 8 .... *$108,000*

SOUTH CAROLINA COMMUNITY STUDIES ON PESTICIDES.

Medical University of South Carolina, 80 Barre Street, Charleston, South Carolina 29401

Contract No. 68-02-1385, Task Order No. 3 .... *$102,000*
CONTROL STRATEGY DEVELOPMENT FOR PARTICULATE MATTER FOR THE METROPOLITAN LOS ANGELES AQCR.
TRW, Inc., 7600 Colshire Drive, McLean, Virginia 22101

SUBJECT FIELDS AND SCOPE NOTES

1. EMISSION SOURCES

Information pertaining to an industry, process, or material associated with air pollution. Documents in this category are concerned primarily with characteristics of a specific class of emission sources including types, rates, industries; secondary coverage may include effects, control methods, etc.

2. CONTROL METHODS

Includes equipment and both specific source control and general abatement efforts. Included are documents describing the operating principles, design, operation, efficiency, etc., of equipment and methods of removing pollutants. The scope of the document can vary from a device for a specific source to an approach applicable to an entire industry--e.g., automobiles.

3. MEASUREMENT METHODS

Includes equipment as well as methods. Confined to development testing and evaluation of pollutant determination methods (sampling, analytical, monitoring) and equipment, as such. Data obtained by use of methods in specific applications are placed in the applicable subject categories.

4. AIR QUALITY MEASUREMENTS

Pollution measurements in the ambient air, generally related to specific geographical locations, such as area surveys. Also includes general reviews of area situations and emission source inventories.

5. ATMOSPHERIC INTERACTION

All chemical and physical phenomena occurring in the atmosphere Included is material on dispersion, air pollution forecasts, meteorological effects, topographical effects, photochemical reactions in the atmosphere, etc. Laboratory studies of photochemical reactions are assigned to Basic Science and Technology.

6. BASIC SCIENCE AND TECHNOLOGY

General discussions or data compilations for the basic physical and chemical properties of pollutants. Theoretical and laboratory studies on related chemical and biological reactions and mechanisms. Mass transfer and other basic knowledge related to process engineering applications in emission control or abatement. Excludes photochemical studies in the atmosphere and biochemical studies related to effects of air pollution.

7. EFFECTS--HUMAN HEALTH

Covers medical and epidemiological studies; biological effects other than those on plants and livestock produced by air pollutants; laboratory animal experiments.

8. EFFECTS--PLANTS AND LIVESTOCK

Effects on vegetation--crops, trees, other plants--and on livestock as distinguished from laboratory experimental animals.

9. EFFECTS--MATERIALS

Deterioration, corrosion, etc., of physical materials, buildings, and structures.

10. ECONOMIC ASPECTS

Economic implications of air pollution and its control, e.g., economic losses from pollution damage, and costs of control programs or equipment in general.

11. STANDARDS AND CRITERIA

Recommended or adopted guides, criteria and standards for allowable emission limits or pollutant concentrations, air quality, equipment characteristics, and fuels.

12. LEGAL AND ADMINISTRATIVE

Legal aspects include legislation, ordinances, rules, litigation, hearings, decisions, etc. Administration covers administrative and miscellaneous information concerning control agencies and control and research programs. Typical topics are personnel, budgets, contractual activities and program descriptions.

13. SOCIAL ASPECTS

Sociological and psychological aspects such as social attitudes public opinion studies, public relations, and public information.

14. GENERAL AND MISCELLANEOUS

Reviews of general problems, trends and background. Documents not assignable to other categories.

ABSTRACT BULLETIN

EMISSION SOURCES

1974

34198 **APTIC NO. 57769**

Sauter, G. D. and W. R. Ott

A COMPUTER PROGRAM FOR PROJECTIONS OF VEHICULAR POLLUTANT EMISSIONS IN URBAN AREAS. *J. Air Pollution Control Assoc., 24(1):54-59, Jan. 1974.*

A description is given of an algorithm for the determination of current and projected annual air pollutant emissions from vehicles in any urban area. A computer program based on this algorithm, PAVE (Projection Algorithm for Vehicular Emissions), has been developed. It is designed to allow the user to include in a realistic manner the many factors which affect vehicular emissions, and the year to year changes in these emissions; these factors include urban growth trends, vehicular age distributions, annual mileages driven by vehicles, the degree to which emissions are controlled, and the deterioration of the control devices in use. A typical running time for this program on modern computers is less than one minute and the cost is only a few dollars. The results of applying the program to emissions from automobiles in the San Francisco Bay Area are presented and discussed. Projections of carbon monoxide, hydrocarbon, and nitrogen oxide automobile emissions were based on a hypothetical control program. With appropriate input data, the program could also be used to estimate total annual emissions for trucks and buses. In spite of the uncertainties in the input data and assumptions upon which the projections were based, several generally valid conclusions could be drawn. The emission control programs presently in effect will result in automobile emissions below those that would be obtained in the absence of a control program. Second, for control programs applying only to new cars, there is a long time lapse (8-10 yr) between the application of the control and its maximum effect. An effective retrofit control program may significantly reduce the time required to reach minimum annual emission levels, but will not reduce these minimum levels substantially. Finally, if the number of vehicle-miles driven in an urban area is allowed to increase without limit, total annual emissions will eventually increase in spite of the most restrictive emission limits imposed on individual vehicles.

1973

34199 **APTIC NO. 57287**

Audere, A. K., Z. Ya. Lindberg, G. A. Smirnov, and L. M. Shabad

EXPERIMENTAL STUDY OF THE EFFECT OF AN AIRPORT, LOCATED WITHIN THE CITY LIMITS, ON ENVIRONMENTAL LEVELS OF BENZO(A)PYRENE CONTAMINATION. *(Opyt izucheniya vliyaniya aerodroma, raspolozhennogo v cherte goroda, na uroven zagryazneniya vneshney sredy benz(a)pirenom). Text in Russian. Gigiena i Sanit., no. 9:90-92, 1973. 2 refs.*

Benzo(a)pyrene levels in snow, soil, and plant material samples taken from the runways of two airports in Moscow and Riga were analyzed. Benzo(a)pyrene levels ranging from 1.3 to 68 micrograms/kg were determined in soil samples from the runway of the Moscow airport. The rate of benzo(a)pyrene accumulation in 40-days-old snow samples from the runway of the Riga airport ranged from 0.19 to 2.16 micrograms/sq m. day. The benzo(a)pyrene contents in soil samples from the same sampling sites were in a range of 6.3-41.8 micrograms/kg. Plant materials collected from the runway zone contained from 2.1 to 20.7 micrograms of benzo(a)pyrene per kg. All values measured are far above the corresponding control levels. Decrease in the benzo(a)pyrene levels with increasing distance from the runway was observed.

34200 **APTIC NO. 57631**

Barrett, R. E., S. E. Miller, and D. W. Locklin

FIELD INVESTIGATION OF EMISSIONS FROM COMBUSTION EQUIPMENT FOR SPACE HEATING. (FINAL REPORT). *Battelle Memorial Inst., Columbus, Ohio, Columbus Labs., Environmental Protection Agency Contract 68-02-0251, EPA-R2-73-084a, Program 1A2015, 200p., June 1973. 15 refs.*

NTIS: PB 223148

Emissions of carbon dioxide, hydrocarbons, nitrogen oxides, sulfur dioxide, particulates, and smoke from 33 residential heating units and 13 commercial boilers were measured over a period of 2 years. Although performance similarities were noted during runs with varied air adjustments, each residential unit had unique emission characteristics. For the representative cross-section of residential units investigated, the largest reduction in emissions was achieved by replacing poorly performing units, as identified from smoke emission measurements made during service inspections. Tuning of the units that were generally performing well reduced smoke levels but produced only slight reductions in emissions on a gravimetric basis. Tuning to lower smoke by increasing the air adjustment alone resulted in sharply rising CO and HC emissions for some units unless established tuning practices were followed using field-type instruments for smoke and CO2 measurements. Burners equipped with flame-retention type combustion heads produced lower emissions than those with conventional heads, and newer burners performed with lower emissions than older burners. Although some performance differences were noted among the commercial boilers, which ranged in capacity from 40 to 600 hp, varying loads and excess air settings within the normal range of adjustment had minor effects on gaseous emissions. Fuel characteristics had a significant effect on emissions, especially particulates and NOx. Particulate emissions with 1% sulfur oil averaged about 30% of those for conventional No. 6 oil; particulate emissions for No. 2 oil averaged only about 3% of those for No. 6 oil. The NOx emissions were lowest with natural gas and the lighter grades of fuel oil; they increased with increasing fuel nitrogen content. New emission factors are suggested for use in emission inventories and in evaluating control strategies. Separate emission factors are suggested for residential oil-fired units and for gas-fired and oil-fired commercial boilers, with a distinction between fuel oil grades or types. (Author abstract)

34201 **APTIC NO. 57267**

Bolton, N. E., J. A. Carter, J. F. Emery, C. Feldman, W. Fulkerson, L. D. Hulett, and W. S. Lyon

TRACE ELEMENT MASS BALANCE AROUND A COAL-FIRED STEAM PLANT. *Am. Chem. Soc., Div.*

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Fuel Chem., Preprints, 18(4):114-123, 1973. 5 refs. (Presented at the American Chemical Society, National Meeting, 166th, Chicago, Ill., Aug. 26-31, 1973.)

A coal-fired steam plant was tested for trace elements during compliance testing of an electrostatic precipitator. Samples were taken of the coal entering the boiler, slag leaving the boiler, inlet air, ducts before and after the precipitator, and in the stack 82 m above the ground. Sampling probes, operating variables, analytical methods (neutron activation analysis, spark source mass spectrometry, and flameless atomic absorption spectrophotometry), and mass balance results are described. Mass balance calculations for eight major elements and 22 minor elements are given, together with corresponding concentrations in the coal, precipitator inlet and outlet fly ash, and in the slag tank solids. Because the method of flue gas sampling was designed primarily to collect particulates efficiently, good balances were not obtained for elements forming volatile compounds. For example, mercury was determined on virtually every sample; however, the major portion of the Hg entering the system via the coal could not be determined. Therefore Hg must be present in the stack gas as a vapor which could not be trapped. Mos Hg values in coal were 0.07 ppm. Very little mercury (approximately 12%) remained in the slag and fly ash. The cold trap only collected 11% of the Hg vapor. The electrostatic precipitator was approximately 98% efficient for most trace elements based on analyses of the fly ash specimens collected from the precipitator inlet and outlet. The exception was selenium. They may indicate that a significant fraction of the material is in the vapor phase in the flue gas.

34202 **APTIC NO. 57337**

Clewell, D. H. and W. J. Koehl

IMPACT OF AUTOMOTIVE EMISSIONS REGULATIONS ON GASOLINE DEMAND. *Energ. Automob., 1973:6-14, July 1973. 26 refs.*

The impact of automotive emissions regulations on the demand for gasoline is discussed. Gasoline demand is projected to increase about 50% from 1973 to 1985 and as much as 70% if the present 1976 nitrogen oxides emission standard is retained and can be approached only by exhaust gas recirculation (EGR). If the dual catalyst system is successful, cars would require 21% more gasoline than did 1970 model cars. The hydrocarbon/ carbon monoxide catalyst plus maximum EGR would increase gasoline demand by 39% over 1970 model cars. Four strategies are suggested as ways to moderate the growth in fuel demand while providing low emission transportation: relaxation of the emission standards, smaller cars, disel-powered cars, and mass transportation.

34203 **APTIC NO. 57176**

Figgen, Werner (ed.)

COLOGNE EMISSIONS INVENTORY A STATUS REPORT ON THE COLOGNE PILOT SCHEME FOR ESTABLISHING AN INVENTORY OF ATMOSPHERIC POLLUTANTS. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 4th Meet., Oberursel, West Germany, 1973, p. X-1-X-47. (May 28-30.)*

Preliminary results of an emissions inventory for the area of Cologne, West Germany, are presented with respect to industry, domestic and industrial heating, and road traffic. Oxides of sulfur accounted for 43% of the total industrial emission, with organic gases and vapors comprising 29%, oxides of nitrogen 19%, and carbon monoxide 5%. Heating for domestic and small business use emitted 67% SOx, 17% NOx, and 5% CO; dusts accounted for almost 9% of the total emissions of industrial furnaces. The most important emission constituent of traffic was carbon monoxide, accounting for 91% of the total. Oxides of nitrogen accounted for 4%. Carbon monoxide was the most abundant constituent in domestic heating/small-business source group (73%), while oxides of sulfur accounted for 12%. The total quantity of organic gas and vapor emissions was estimated at 30,000 metric tons/year, and 68% of this was in the form of hydrocarbons.

34204 **APTIC NO. 57342**

Goedseels, V.

EVALUATION OF THE ODOROUS EMISSIONS IN RELATION TO THE INFRASTRUCTURE OF INTENSE CATTLE RAISING. *(De evaluatie van de odorantemissie in relatie tot de infrastruktuur van intensieve veebedrifven). Text in Dutch. Ingenieursblad, 42(20):557-564, 1973. 12 refs.*

General problems of malodorous emissions in intense cattle-raising units are discussed with respect to odor control by appropriate building design. Hydrogen sulfide, ammonia, carbon dioxide, and possibly methane are the chief emissions in cattle-raising units. In poultry houses and pigsties, various organic emissions, such as ethylamine, methylamine, triethylamine, N-propylamine, isopropylamine, pentylamine, methanol, ethanol, N-propanol, isopropanol, N-butanol, isobutanol, isopentanol, formaldehyde, acetaldehyde, propionaldehyde, isobutyraldehyde, heptaldehyde, valeraldehyde, octaldehyde, and decaldehyde are identified in the air. Exposure to 100-200 ppm concentrations of NM3 caused irritation of the respiratory tract and anorexia in swines. Eye irritation and anorexia due to 200 ppm of NM3, photophobia due to 1000 ppm, and keratoconjunctivities due to 2000 ppm were caused in poultry. Hydrogen sulfide in concentrations of 20 to 200 ppm caused photphobia, anorexia, and diarrhea in swines.

34205 **APTIC NO. 57674**

Goldish, J., G. Margolis, J. Ehrenfeld, and R. Bernstein

SYSTEMS STUDY OF CONVENTIONAL COMBUSTION SOURCES IN THE IRON AND STEEL INDUSTRY (FINAL REPORT). *Walden Research Corp., Cambridge, Mass., Environmental Protection Agency Contract EHSD 71-21, Program Element 1A2014, EPA-R2-73-192, 223p., April 1973. 75 refs.*

NTIS: PB 226294/AS

A systems study of conventional combustion sources in the iron and steel industry was performed; and pollutant sources were defined according to equipment, size, regional distribution, fuel, firing type, age, and other factors of significance to air pollution emissions. Estimates of installed capacity were made for the base year 1970, and projections were made for 1975 and 1980. The results of the study indicated that steam-raising boilers are a significant source of air pollution in the industry; these boilers were found to emit about 1/3 the particulate loadings of the process emissions, about 1/2 of the total sulfur dioxide, and 2/3 of the total oxides of nitrogen. A significant fraction of the particulate and SO2 emissions from the boilers resulted from the combustion of conventional fossil fuels which are relatively dirty (with respect to particulates and sulfurs), compared to coke oven gas and blast furnace gas. Control strategy cost-effectiveness analyses indicated that fuel switching would be the most effective means of control. (Author conclusions modified)

34206 **APTIC NO. 56995**

Hishida, Kazuo, Hisao Nihei, Kenji Ikeda, Kiyomi Sasaki, Shigeru Yasaki, and Takeshi Saito

EMISSION FACTORS FOR MOBILE SOURCES (PART II), AUTOMOBILES. *(Emisshon fakuta ni tsuite, ido hasseigen (sono 2), gasorin jidosha ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):339, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 84.)*

Based on the studies of automobile driving patterns in Tokyo, exhaust emission gases were measured and emission factors were calculated by car types. In this report, gasoline and LPG automobile, small gasoline automobile, and truck emission factors are presented in tables. A total of 30 vehicles and their driving modes, the measurements of carbon monoxide, hydrocarbons, nitrogen oxides, aldehydes, sulfur oxides, and fuel consumptions were examined. High measurements of CO were detected during the peak-low speed driving of gasoline and LPG automobiles and gasoline small automobile. Carbon monoxide was high during the peak mean driving speed of trucks. Considerable emission of HC occurred when trucks drove at the peak low-speed and when light gasoline automobiles drove in any mode. The amounts of NOx were high in emissions from LP automobiles and gasoline trucks in any mode and extremely low in that of small gasoline auto. The fuel consumption tended to increase at peak low-speed driving by any type of vehicle.

34207 **APTIC NO. 57125**

Hishida, Kazuo, Hisao Nihei, Kenji Ikeda, Takeshi Saito, Kunio Yamakawa, and Naoomi Yamaki

EMISSION FACTORS FOR MOBILE SOURCES (PART I), STUDIES ON DRIVING PATTERN IN TOKYO. *(Emisshon fakuta ni tsuite ido hasseigen (sono 1), tonai soko modo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):338, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 83.)*

Air pollutant for mobile sources emission factors in Tokyo were investigated. A total of 18 routes of main arteries and supplementary roads, types of cars, small and large automobiles, trucks and buses, between 7 am and 7 pm (peak period), and off-peak period, and driving conditions with regard to idling, accelerating, steady speed, and change of speed were examined. The speed, engine rotation, suction load, acceleration, fuel consumption for gasoline and diesel cars were separately measured. Records were made on data recorder tapes, and the data were analyzed by computer. The driving patterns in Tokyo with regard to peak means, peak-high speed, peak-low speed, and off-peak speed of various cars were calculated. The results are presented in tables.

34208 **APTIC NO. 57128**

Hishida, Kazuo, Hisao Nihei, and Kenji Ikeda

ANALYSIS OF HEAVY METALS IN EXHAUST GAS OF AUTOMOBILE ATTACHED CATALYTIC CONVERTER. *(Shokubaishiki sainensho sochi toritsukesha no haiki gasu-chu biryushijo busshitsu (kinzoku) ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):337, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 82.)*

To confirm the safety of automobile catalytic converters, the measurements of microparticles of heavy metals from catalysts were taken. An automobile with a mileage of 15,000 km after the installation of catalytic converter was operated on chassis dynamometer, and exhaust gases were examined ten times, at 4 modes. Samples were taken by hi-vol sampler and the particles on the filter were analyzed by atomic absorption spectrophotometry. The elements analyzed were aluminum, cobalt, chromium, iron, manganese, lead, palladium, platinum, and vanadium. Lead from gasoline s lead tetraethyl, Mn, Cr, and Pd from the catalyst, and Fe from the inner walls of muffler pipe, gasoline, and catalyst were detected but in extremely small quantities. Further examinations are necessary to confirm this result.

34209 **APTIC NO. 56970**

Hori, Masahiro, Noboru Tanigawa, and Yoshitaka Kobayashi

INVESTIGATION OF LEAD COMPOUNDS IN EXHAUST GASES FROM VARIOUS KINDS OF SOURCES. *(Kotei hasseigen ni okeru hai gasu-chu no enkagobutsu ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):344, Oct. 1973. (Presented at the Japan. Society for Air Pollution), 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 88.)*

The lead emission quantities from fixed sources, concentrations, lead compounds, and particle distributions were examined in order to compare them with those in automotive exhaust gases. The fixed sources examined were a battery plant, a cable manufacturing plant, a steel industry, a plastic incineration, a sanitation plant, and a heavy oil boiler. Samplings were taken by a glass fiber filter paper sampler and measured by polarography. For plants with dust collection systems, the Pb concentration in effluents before and after the control were measured. The Pb compounds were determined by x-ray refraction. Particle distributions were examined by cascade impacter and polarography. The Pb concentration in fixed-source flue gases ranged between 10,000 to 10,000,000 times the concentration of lead in the air. This is similar, or more, than automotive exhaust gases. The amount of emission from one source is equivalent to the amount from a considerable number of automobiles. The compound types are lead dioxide, yellow lead monoxide, lead sulfide, lead sulfate, lead chloride, and 2PbO. The results of particle size measurements were not totally reliable; but it seemed more than half were micro-particles which could easily invade the respiratory system.

34210 **APTIC NO. 57682**

Jacko, M. G. and R. T. DuCharme

BRAKE EMISSIONS: EMISSION MEASUREMENTS FROM BRAKE AND CLUTCH LININGS FROM SELECTED MOBILE SOURCES. (FINAL REPORT). *Bendix Research Labs., Southfield, Mich., Materials and Processes Dept. Environmental Protection Agency Contract 68-04-0020, Rept. 68-04-0020, APTD-1557, 334p., 1973. 68 refs.*

NTIS: PB 222372

In order to define the extent of gas and particulate emissions from automotive brakes and clutches, a combination separation and storage collection system was devised. Unique emissions collectors for both disc and drum brakes and for a clutch were conceived, designed, and built as the main embodiment of this instrumentation. The hardware was installed on a vehicle which was then driven through various test cycles to determine the extent and type of brake emissions generated at low and high operating temperatures. Typical driving conditions and more abusive driving conditions were included. Typical original equipment and aftermarket friction materials for both disc and drum brakes were used in the tests. Brake relines simulated typical consumer practices. The brake emissions generated were removed from the collectors, and mass balances were performed. The particulates were processed and analyzed by a combination of optical and electron microscopy to ascertain the asbestos content and the asbestos particle size distribution in the wear debris. Comparisons of emissions from new and used friction materials, disc and drum brakes, and original equipment and aftermarket materials were made. An estimate was also made of the total emission of asbestos by all of the vehicles (trucks and cars) in the country; on the average, more than 99.7% of the asbestos is converted; the contribution to the atmosphere is 5060 lbs, or 3.2% of the total asbestos emissions. (Author abstract)

34211 **APTIC NO. 57679**

Jimeson, Robert M.

THE FUTURE DEMAND FOR ELECTRIC POWER AND VARIOUS FUELS. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa. 28p., 1973. 5 refs. (Presented at the Air Pollution Control Association symposium on Fuels and Power, Annual Meeting, 66th, Chicago, Ill., June 26, 1973, Paper 73-61.)*

The demand for primary energy and electric power is forecast, the mix of expected generating facilities is delineated and translated into the quantity and quality of various fuels needed to meet the demand, recent costs of a variety of utility fuels by type and quality are summarized, and composite environmental control costs applicable to the electric power industry are estimated. The growth of total energy demand is expected to increase rapidly through the remaining portion of this century, with the demand for electricity increasing at a more rapid rate than that of total energy. Additional quantities of fossil fuels will be required to meet the demand even though a large proportion of electricity will be generated by nuclear energy. The trend will be for fewer generating sites with larger capacity units. The high cost of stack gas scrubbing provides considerable latitude for competitively processing high sulfur fuels to environmentally acceptable levels, and the use of clean fuels is more desirable than stack-gas scrubbing because of the nature of utility operations. The average cost per kilowatt-hour for environmental control is expected to be less in the future due to the increasing use of nuclear generating facilities. (Author summary modified)

34212 **APTIC NO. 57824**

Lee, Robert E., Jr., Howard L. Crist, Allen E. Riley, and Kathryn E. MacLeod

THE CONCENTRATION AND SIZE OF TRACE METAL EMISSIONS FROM A POWER PLANT, A STEEL PLANT, AND A COTTON GIN. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., National Environmental Research Center, 23p., 1973. 16 refs.*

An in-stack cascade impactor was used to determine the size distribution of particles, before and after emission control systems, of a coal-fired power plant, a steel plant, and a cotton gin. Samples were analyzed for total particulate matter and elemental metal content by graphite-furnace atomic absorption; selenium was analyzed by neutron activation. A sharp decrease in the concentration and particle size was observed after the particulates passed through the control systems. Pronounced metal concentration and particle size relationships were found in the power plant and steel plant samples. The power plant outlet samples showed a concentration of chromium, lead, antimony, zinc, and selenium in the particle size range of 0-1 micron in diameter. The baghouse control system on the steel plant was extremely efficient in removing metal-containing particles below 5 micron in diameter. Mass and particle size distribution were correlated for particulates collected before and after an electrostatic precipitator at a coal-fired power plant, before and after a baghouse at an electric arc furnace steel plant, and before and after a wet scrubber at a cotton gin. Potential sources of error in the study were associated with the accuracy of the sampling method, and included wall loss effects, particle reentrainment, and calibration inaccuracies. (Author abstract modified)

34213 **APTIC NO. 57304**

Levai, Andras

ENERGETICS AND ENVIRONMENTAL POLLUTION. *(Energetika es kornyezetszennyezes). Text in Hungarian. Musz. Tud., 46(3-4):315-329, 1973. 22 refs.*

General problems of environmental pollution in energetics are discussed in connection with the program of a special environmental research and development plan, approved recently by the Hungarian Government. Forecasts concerning the distribution of all energy carriers until the year 2000 indicate a shift toward liquid and gaseous, as well as nuclear energy carriers at the expense of solid energy carriers. Carbon dioxide, carbon monoxide, sulfur dioxide, hydrocarbons, nitrogen oxides, fly ash, soot, and waste heat are among the chief air pollutants emitted by power plants, and partly by motor vehicles. A close correlation, with a factor of 0.96, between the ambient temperature and the mean values of the atmospheric SO_2 concentrations in Budapest was determined. Fly ash and SO_2 emissions from power plants and other firing equipment can be effectively reduced by shifting to another type of fuel within the limits of possibility. Flue gas desulfurization, and especially the less expensive fuel desulfurization will be essential means of SO_2 pollution abatement. Local and regional pollution, especially in big cities can be abated considerably by means of remote-heating systems. Combinations of electric and thermal energy generation will be essential.

34214 **APTIC NO. 57686**

Melton, C. W., R. I. Mitchell, D. A. Trayser, and J. F. Foster

CHEMICAL AND PHYSICAL CHARACTERIZATION OF AUTOMOTIVE EXHAUST PARTICULATE MATTER IN THE ATMOSPHERE. (FINAL SUMMARY REPORT). *Battelle Memorial Inst., Columbus, Ohio, Columbus Labs. Environmental Protection Agency Contract 68-02-0205, CRC-APRAC Proj. CAPE-19-70, Rept. EPA-650/2-73-001, 89p., June 14, 1973.*

NTIS: PB-221603

Two matched automobiles representing a typical and large volume sales car model generated exhaust particulate matter in order to characterize the physical and chemical properties of automotive exhaust particulates. Measurements of the mass of particulate emissions collected on Metricel-DM membrane filters showed variations in the collected amounts with the face velocity of the exhaust as well as with the operating cycle and fuel used. Particle size distributions were measured in a Battelle impactor. Examination of the properties of the aerosol particles in diluted exhaust while the aerosol was aged in a residence chamber indicated that the smallest particles below thy light scattering range agglomerate or grow during the first two hours to a size sufficient to scatter light. Thereafter light scattering measurements indicated little change in the aerosol, though some particle growth appeared to continue as long as 24 hours. Weight gains recorded after filtration of identical volumes of gas in concurrent samples (60 min at 1 cfm) varied widely and correlated qualitatively with the diameters or areas of filters used. No conclusions were possible concerning the absolute weight concentration of the filterable aerosol particles. (Author summary modified)

34215 **APTIC NO. 57768**

Panduranga, V.

HYDROCARBON EMISSION FROM AUTOMOTIVE ENGINES. *Indian J. Technol. (India), vol. 11:110-112, March 1973. 12 refs.*

The concentration of unburned hydrocarbons emitted in the exhaust of automotive engines was calculated using quench theory. The effect of constructional and operational parameters, such as the surface to volume ratio of the combustion chamber, compression ratio, inlet pressure, inlet temperature, and air/fuel ratio on hydrocarbon emission was studied theoretically for two engines. The theoretical results were compared with the measured concentrations of unburned hydrocarbons. (Author abstract)

34216 **APTIC NO. 57820**

Pershing, D. W., G. B. Martin, and E. E. Berkau

INFLUENCE OF DESIGN VARIABLES ON THE PRODUCTION OF THERMAL AND FUEL NO FROM RESIDUAL OIL AND COAL COMBUSTION. *Preprint, American Inst. of Chemical Engineers, 48p., 1973. 21 refs. (Presented at the American Institute of Chemical Engineers, Annual Meeting, 66th, Philadelphia, Pa., Nov. 11-15, 1973, Paper 22C.)*

A versatile laboratory furnace was used to study the nitrogen oxide emissions resulting from the combustion of low-sulfur residual oil and pulverized coal. The relative contributions of thermal fixation and fuel nitrogen oxidation to the total NO_x emissions were determined by comparing the results from combustion with air with those from combustion with the appropriate argon/oxygen mixture. Subsequent testing on both oil and coal was then conducted to determine how the total NO_x and these relative contributions from fuel NO_x and thermal

NOx depended on burner throat velocity, excess air, air preheat, secondary air swirl, and flue gas recirculation. In each case care was exercised to allow only one of the variables to be changed at a time. For coal-firing under all conditions tested, the bulk of NOx resulted from fuel nitrogen oxidation. For residual oil, although fuel NOx was always significant, the thermal NOx contribution was negligible at low preheat conditions and was significant at high preheat conditions. Increased burner throat velocities and flue gas recirculation gave small NOx reductions which were probably associated with elimination of much of the thermal NOx. Increased air preheat associated with elimination of much of the thermal NOx. Increased air preheat increased NOx with both coal and oil. Thermal and fuel NOx increased markedly with increasing excess air for both oil and coal. (Author abstract modified)

34217 **APTIC NO. 57129**

Rokushika, Tsuruo and Mitsuko Aoyama

INVESTIGATION OF CO, HC CONCENTRATION IN VARIOUS VEHICLE EXHAUST. *(Shashubetsu ni mita jidosha haishutsu gasu-chu no CO, HC nodo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):328, Oct. 1973. (Presented at the Japan. Society of Air Pollution, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 73.)*

Carbon monoxide and hydrocarbon concentrations were measured in the exhaust pipes of 225 gasoline cars during idling driving. The average concentration of CO was 3.1% and was similar to the measurements taken from 108 cars in August of 1972, which was 3.2%. Compared to the average 5.1% of the 1969 investigation, this was a considerable improvement; but 22.7% of the total number of cars, or 51 exceeded the maximum allowable concentration of 4.5%. The number of cars exceeding 4.5% CO was slightly lower among the 1972 and 1973 automobiles, compared to other years. The cars with an HC concentration of less than 1000 ppm were 184 and 81.5% of the total; the average was 396.5 ppm. The number of 1972-1973 cars exceeding 1000 ppm was clearly smaller than that of older cars. Compared to cars with spark timing adjustment, those with exhaust control devices emitted slightly less than 1000 ppm HC. There was no correlation between CO and HC concentrations.

34218 **APTIC NO. 57326**

Ross, Fraser F.

THY PROBLEM OF SULFUR DIOXIDE. *(Quel est le probleme du dioxyde de soufre)? Text in French. Pollut. Atmos. (Paris), 15(58):117-122, April-June, 1973.*

The air pollution problems posed by sulfur dioxide and the economical implications are discussed. In small quantities, SO2 is a natural and essential compound of the atmospheric air. Large quantities of sulfur are found in Central Africa and the United States. A certain region in Great Britain produces a quantity of SO2 six times higher than that produced in the United States per surface unit. Sulfur is a nutritional compound for plants. The emissions of SO2 in the U. S. have been estimated to reach 35,000,000 tons at present, and will reach 60,000,000 tons in 1980. The allowed concentration is 0.15 ppm. Concentrations of 1500 micrograms/cu m were registered in London in June 1970, while concentrations of 1000 micrograms/cu m were considered harmful to health during a research conducted at the St. Bartholomew Hospital. The quantitative SO2 emissions in the U. S. in 1968 were from the following sources: 16,800,000 tons from electric power plants; 5,100,000 tons from industry; 2,500,000 from residential and commercial quarters, including 500,000 tons from automobiles. The average SO2 emissions do not exceed 1000 micrograms/cu m and 200 kg/hr/km. A maximum of normal dose per 3 min is given by the equation P equals Q multiplied by 1,000,000 micrograms/cu m divided by 7 pi square H, where Q is expressed in SO2 g/sec, 7 is a nominal wind speed in m/sec, and H is altitude in m. Graphs were prepared for industries using motor oil. In controlling air pollution, there are limitations posed by the chimneys. They are: height, motor oil quantities processed, carbon quantities. One of the solutions suggested is elimination of certain pyrites from coal. In order to protect nature and man, sulfur dioxide emissions should be limited to 1% content; between 3.5% in residual motor oils to 2.5% in coals; and utilization in great industrial installations of residual motor oil with a 2% sulfur content and of coal with a 1.5% sulfur content by elimination of certain pyrites.

34219 **APTIC NO. 56962**

Schroedter, W., P. Studt, and P. Voigtsberger

INVESTIGATIONS ON THE CARCINOGENIC BURDEN BY AIR POLLUTION IN MAN. IV. A CONTRIBUTION TO THE EXAMINATION OF CARCINOGENIC SUBSTANCES IN EMISSIONS OF OTTOMOTORS. *Zentralbl. Bakteriol., Parasitenk. Infektionskr. Hyg.: Abt. 1; Orig., Reihe B, 158(1):50-58, 1973. 4 refs.*

A VW 1500 Variant with air-cooled 4-cylinder Boxer-engine, 44 hp output was subjected to a modified European test procedure. The exhaust gas was led to the open air via a 1 m long, pliable, refined steel tube, a water-cooled refined steel tube heat- exchanger, and a micron filter connecting directly to the tube cooler. Inside the tube cooler the water contained in the exhaust gas was compressed to saturation pressure at 20 C (18 torr). In the aqueous condensate from the tube cooler as well as in the substances collected in the micron filter, the concentration of the polycyclic aromatic hydrocarbons was determined. The results are listed in a table and illustrated graphically. Benzo(a)pyrene and benzo(e)pyrene were present in about the same average concentration of approximately 50 micrograms/cu m. The concentration of carcinogenic substances was higher by factor of 20 under cold start driving conditions compared to normal operating conditions with the motor oil temperature of 60 C and above. For instance, 89 micrograms benzo(a)pyrene/cu m exhaust gas were measured under cold start conditions. This concentration went down to 4.5 microgram/cu m once the oil temperature reached 60 C.

34220 **APTIC NO. 57231**

Schultz, Hyman, E. A. Hattman, and W. B. Booher

THE FATE OF SOME TRACE ELEMENTS DURING COAL PRETREATMENT AND COMBUSTION. *Am. Chem. Soc., Div. Fuel Chem., Preprints, 18(4):108-113, 1973. (Presented at the American Chemical Society, National Meeting, 166th, Chicago, Ill., Aug. 26-31, 1973.)*

In one study, selected coals were crushed and separated in organic fluids of known specific gravity. The starting coal and each specific gravity fraction were analyzed for the trace elements mercury, copper, chromium, manganese, nickel, and fluorine. In the second study, coal was combusted in a 100 g/hr combustor, and the ash and flue gases were collected and analyzed for mercury, cadmium, and lead. Then coal and ash were obtained from a 500 lbs/hr furnace and from commercial power plants. Analytical methods and results are described. As much as 40% of the mercury in the coal was associated with the high specific gravity fraction of the coal. Thus, if the pyrite is removed from coal to lower sulfur emissions, a substantial part of the mercury is also removed at no extra cost. About 10-15% of the mercury from the coal may remain in the fly ash in coal-burning power plants. Taking both factors into consideration could reduce the maximum emission of mercury to about 50% of that present in the coal. Cadmium and lead are less volatile than mercury, and thus they are retained in the fly ash to a greater extent than Hg. It is expected that even less volatile elements would be retained in the fly ash to an even greater extent than Pb and Cd. Determinations of fluorine, copper, manganese, chromium, and nickel were only preliminary and emphasized the difficulties inherent in trace analyses of matrices as complex as coal. Trace analysis require extreme vigilance. Coal handling procedures themselves may add trace elements to the coal. (Author summary modified)

34221 **APTIC NO. 57347**

Spynu, Ye. I., L. N. Ivanova, and A. V. Bolotnyy

ENVIRONMENTAL POLLUTION DUE TO ORGANOPHOSPHORUS PESTICIDES. *(Zagryazneniye okruzhayushchey sredy fosfororganicheskimi pestitsidami). Text in Russian. Gigiena i Sanit., no. 10:75-79, 1973. 26 refs.*

Studies on the contamination of air, soil, plants, and water with organophosphorus pesticides following their application for plant protection purposes are reviewed. Increased in-the-air concentrations of organophosphorus pesticides following their application in tropic and subtropic areas as compared moderate climate zones were measured. Pesticide concentrations of 0.0001-25 micrograms/cu m were measured for a limited time after application. The repeated application of organophosphorus pesticides over large areas, especially from airplanes may cause local or regional air pollution. Secondary emission of deposited methylmercaptophos and butyphos for 10 and 6 days following application, respectively, were observed. Many organophosphorus pesticides are detectable in the air at distances of 50 to 2000 m for 3 to 8 days following application. Malathion and thiophos were detected in the air for 3 weeks and one day only, respectively. Methylmercaptophos, butyphos, rogor, trichlorfon, and carbophos were detected in the air at distances up to 20 km from the site of application.

34222 **APTIC NO. 57527**

Staiff, Donald C., Griffith E. Quinby, David L. Spencer, and Herbert G. Starr, Jr.

POLYCHLORINATED BIPHENYL EMISSION FROM FLUORESCENT LAMP BALLASTS. *Preprint, Environmental Protection Agency, Wenatchee, Wash., Field Studies Section and Colorado Community Study on Pesticides, Greeley, Colo., 11p., 1973 (?). 10 refs.*

Polychlorinated biphenyls (PCB) are used as an insulating liquid in ballasts for fluorescent light fixtures. Ballasts were tested to determine which compounds, if any, are emitted when the ballasts burn out. Samples were taken at different distances 5 min after objectionable odor and fluid leakage indicated a burnout. Three days later additional air samples were collected at the same locations, and several weeks later samples were taken at different distances from normally operating fluorescent lights. In a second series of tests, both burned out and operating ballasts were heated at various temperature. Air samples were drawn from the test chambers during 30-minute periods when the temperatures of the lower sides of the ballast casing were 150, 300, and 400 C to determine emission of PCBs and fluid leakage. A third series of tests were carried out to determine low-level PCB emissions from fluorescent lights with a cloth screen. Polychlorinated biphenyls were emitted during burnout. Even though the levels were well below that of a health hazard, the PCBs may be undesirable in certain laboratories where detection of trace elements is necessary. Emissions from normally operating fluorescent lights were very low. The levels were insignificant compared to the established threshold limit of 1 mg/cu m for Acroclor 1242. New fluorescent light ballasts may have no PCB emissions, and certain older ballasts in normally operating lights may emit even more than indicated in the tests; this could not be clarified with the limited experimentation. New lights with thermal protective switches to prevent overheating and burnout should not emit PCBs.

34223 **APTIC NO. 57707**

Tada, Osamu

TOXIC SUBSTANCES IN WORK ENVIRONMENT. (2) ORGANIC SOLVENT VAPOR IN THE ATMOSPHERE OF WORKSHOPS OF METAL DEGREASING, PAINTING, PRINTING, CEMENTING AND ORGANIC SYNTHESIS. *(Henyo suru shokuba kankyo to yugaibutsu. (2) Dasshi senjo, toso, insatsu, secchaku, yuki gosei). Text in Japanese. Rodo Kagaku (J. Sci. Labour, Tokyo), 49(10):593-610, 1973. 36 refs.*

The environmental health hazard of organic solvents is reviewed on the basis of data in workshops of metal degreasing, painting, printing, cementing, and organic synthesis industries. Trichloroethylene concentrations were high in the 1950 s in metal degreasing shops. Vapors of trichloroethylene, tetrachloroethylene, and toluene, the main ingredients of solvents, were found in degreasing shops from 1963 to 1972. They may be toxic in chronic exposures. Health hazards were great in paint spraying. In the 1950 s, high concentrations of benzene and methanol were found in painting or varnish painting shops. In the 1960 s, toluenes and xylenes were used more than benzenes in paint thinner, and the hazard due to these solvents was decreased because of improved spraying booths. In recent years, some cases of high solvent vapor concentrations were found in paint spraying in narrow closed spaces. In ditto, rotogravure, and intaglio printing shops, high concentrations of methanol vapors were detected. Organic solvents such as toluene, xylene, and methyl-isobutyl-ketone were in high concentrations near the inking tank of rotogravure printing machines. The potential hazard in intaglio printing decreased after methyl-chloroform replaced trichloroethylene in printing roll cleaning. Benzene vapor concentrations were high in workrooms where gum was used in rubber cementing. Since 1960, benzene vapor was replaced by toluene, and high concentrations of methanol were detected. High solvent concentrations were also found in chemical factories producing synthetic drugs, varnish, and inks.

34224 **APTIC NO. 57275**

Environmental Protection Agency, Research Triangle Park, N. C., Office of Air and Water Programs

BACKGROUND INFORMATION FOR PROPOSED NEW SOURCE PERFORMANCE STANDARDS: ASPHALT CONCRETE PLANTS, PETROLEUM REFINERIES, STORAGE VESSELS, SECONDARY LEAD SMELTERS AND REFINERIES, BRASS OR BRONZE INGOT PRODUCTION PLANTS, IRON AND STEEL PLANTS, SEWAGE TREATMENT PLANTS. VOLUME 2, APPENDIX: SUMMARIES OF TEST DATA. (FINAL REPORT). *APTD-1352b, 69p., June 1973.*

Summaries of source tests for particulate matter and carbon monoxide, principally, are provided for: hot mix asphalt concrete plants, catalytic cracking units of petroleum refineries, secondary lead smelters and refineries, secondary brass and bronze refining, basic oxygen process furnaces of iron and steel mills, and sewage sludge incinerators of sewage treatment plants. Most of the tests summarized were conducted using the reference test methods of 40 GFR 60; although, wherever particulate tests were conducted, additional measurements were made to evaluate materials that condense and collect in impingers.

34225 **APTIC NO. 57496**

Environmental Protection Agency, Research Triangle Park, N. C., Air Pollution Technical Information Center

AIR POLLUTION ASPECTS OF EMISSION SOURCES: PRIMARY LEAD PRODUCTION-A BIBLIOGRAPHY WITH ABSTRACTS. *Rept. AP-126, 34p., June 1973. 89 refs.*

NTIS: PB 224869/AS; GPO

A bibliography with abstracts has been compiled by the Air Pollution Technical Information Center of the Office of Air Quality Planning and Standards for air pollution aspects related to primary lead production. Categories referred to include: emission sources, control methods, air quality measurements, atmospheric interaction, basic science and technology, effects on human health, economic effects, effects on plants and livestock, standards and criteria, and legal and administrative. Author and subject indices are also included.

34226 **APTIC NO. 57649**

Office of Air and Water Programs, Research Triangle Park, N. C., Office of Air Quality Planning and Standards

COMPILATION OF AIR POLLUTION EMISSION FACTORS. *2nd ed., AP-42, 406p., April 1973. 528 refs.*

NTIS: PB-223996/AS; GPO

Emission data obtained from source tests, material balance studies, and engineering estimates were compiled for use by individuals and groups responsible for conducting air pollution emission inventories. The emission factors cover the following emission categories: external combustion sources, solid waste disposal, internal combustion engine sources, evaporation loss sources, chemical process industry, food and agricultural industry, metallurgical industry, mineral products industry, petroleum industry, and wood processing. When no source test data are available, these factors can be used to estimate the quantities of primary pollutants (particulates, carbon dioxide, sulfur dioxide, nitrogen oxides, and hydrocarbons) being released from a source of source group. (Author abstract modified)

34227 **APTIC NO. 57687**

Processes Research, Inc., Cincinnati, Ohio, Industrial Planning and Research

SCREENING STUDY FOR BACKGROUND INFORMATION AND SIGNIFICANT EMISSIONS FROM GYPSUM PRODUCT MANUFACTURING. *Environmental Protection Agency Contract 68-02-0242, Task 14, EPA-R2-73-286, 49p., May 1973.*

NTIS: PB 222736

The atmospheric emissions produced during the operation of calcining gypsum and the production of gypsum board products were studied. The average particulate emissions from these plants are between 25 and 40 lbs/hr, with baghouse collectors and electrostatic precipitators generally being employed as control devices. If all plants were so equipped, the total nationwide particulate emissions would be 12,000 tons/yr. Extrapolation of the emissions from all plants indicate that the total emissions are in the range of 80,000 tons/yr. The emission of sulfur oxides is primarily dependent upon the sulfur content of the fuels being used for calcining and other operations, and the production of nitrogen oxides is also a function of the combustion equipment and fuels used. Emission regulations relating to visible, particulate, sulfur oxide, and nitrogen oxide emissions are shown for nine states. A description of a general process for the production of calcined gypsum and gypsum board products is given with flow diagrams. A list of gypsum and/or gypsum product producers is shown, along with total industry production capacity, best controlled plants and their control equipment, and emissions data from various production locations. A brief description of emission analysis, applicable control technology, and the economics of control equipment is included. (Author abstract modified)

1972

34228 **APTIC NO. 57539**

Brychta, Miroslav

FUEL AND POWER GENERATION BASE OF THE CZECHOSLOVAK REPUBLIC. *(Palivo-energeticka Zakladna CSSR). Text in Czech. Ustav pro Vyzkum a Vyuziti Paliv, Prague (Czechoslovakia), Sb. Prednasek 50 (Padesatemu) Vyroci Ustavu Vyzk. Vyuziti Paliv, 1972, p. 1-10.*

Characteristics of the fuel and power generation base of the Czechoslovak Republic in the past and present are described. Outputs of hard and brown coal and electric power generation from 1937 to 1970 are mentioned. The development of primary energy consumption in Czechoslovakia in this period is compared to that in the whole world, summary data regarding 1921 to 1969 are calculated. Special attention is concentrated on the critical analysis of the specific consumption of primary energy per capita in Czechoslovakia and in the world as well as on the specific consumption of primary energy related to the gross national product. While the specific consumption per capita in Czechoslovakia corresponds with the average consumption in progressive countries, the specific consumption for the gross national product in Czechoslovakia remains behind the values of these countries. The main causes illustrating this state are given.

34229 **APTIC NO. 57350**

Hall, J. Alfred

FOREST FUELS, PRESCRIBED FIRE, AND AIR QUALITY. *Forest Service, Portland, Oreg., Pacific Northwest Forest and Range Experiment Station, 46p., 1972. 64 refs.*

A report is presented on the effects of prescribed forest burning on emission of air pollutants. The burning of forest fuels is a mixture of the products of distillation, thermal decomposition, and flaming and nonflaming combustion. The visible cloud of smoke from a slash fire is nearly all water; and the behavior of the cloud and its appearance are functions of air temperature, relative humidity, the size and energy content of the combustion column, and a host of other factors that need study. The sulfur content of wood is negligible, so there is no problem with sulfur dioxide. The temperature attained in burning forest fuels is generally too low to permit formation of nitric oxide. Evidence of increase concentrations of carbon monoxide at short distances from going fires is lacking, and the possibility of enhancing dangerous concentrations of carbon monoxide at street level in cities is so remote as to be disregarded. Only small traces of photochemically active hydrocarbon compounds of low molecular weight have been found to be produced, and its is unknown wheather polynuclear aromatic hydrocarbons are produced as a result of forest burning. Particulate matter, largely carbon particles, must also contain material of the nature of aerosols formed by intermolecular condensation of terpenoids, phenols, and reactive aldehydes, partially adsorbed on carbon. They are probably indistinguishable in their chemical nature from many components of the atmosphere produced in normal natural processes.

34230 **APTIC NO. 57538**

Janac, Jiri

CONTROL OF COMBUSTION CHARACTERISTICS OF GASES. *(Kontrola spalovacich vlastnosti plynu). Text in Czech. Ustav pro Vyzkum a Vyuziti Paliv, Prague (Czechoslovakia), Sb. Prednasek 50 (Padesatemu) Vyroci Ustavu Vyzk. Vyuziti Paliv, 1972, p. 267-287. 24 refs.*

Conditions for introducing the automatic control of combustion characteristics of town gas at both the producers and industrial consumers were studied. In the initial stage, a method suitable for an automatic measurement was worked out. The method consists of the correlation between the Wobbe number, the maximum burning velocity, and the number of the Ott test burner. Limits of interchangeability can thus be determined in a diagram of interchangeability by means of two quantities, i.e., the modified Wobbe number and the Ott number. A suitable device was designed for the automatic determination of the Ott number. Properties of the Ott test burner were investigated in more detail, and equations giving physical importance to its data were derived. An empirical relation between the height of the internal cone of the Bunsen burners and the Ott number was found; by means of this relation, the allowable fluctuation of the worked out method parameters could be determined. Equations for calculating the Ott number on the basis of gas composition were derived.

34231 **APTIC NO. 57297**

Kiese, Olaf

THE ROLE OF ARTIFICIALLY GENERATED HEAT IN THE ATMOSPHERE). *(Die Rolle kunstlich erzeugter Warme in der Atmosphaere).* Text in German. Society for Ecology, *Proc. Conf. Land Loadability Ecosystems, Giessen, West Germany, 1972, p. 175-179.*

The possible effect of artificially generated heat, fossil or nuclear in its origin, on the overall heat budget of the atmosphere is discussed. While the fossil fuel resources of the earth when burned would be most unlikely to affect the overall heat budget of the atmosphere, the increased use of nuclear energy, along with the rapid increase in the energy demand worldwide, could lead in the distant future to changes in this heat budget. The concentrated use of energy in densely populated and highly industrialized areas is only one, and not necessarily the dominant, factor conditioning the formation of special climatic conditions in such areas. Thermal power plants as point heat emission sources also modify the local climate. In the future, the increase in the energy demand will be much higher than that in concentration of the energy use.

34232 **APTIC NO. 57389**

Neporozhnij, P. S.

CONTEMPORARY AND FUTURE ENERGY. *(A vilag mai es holnapi energiagazdalkodasa).* Text in Hungarian. *Energia Atomtech. (Budapest), 25(8-9):347-349, Aug.-Sept. 1972.*

State-of-the-art and future perspectives of the energy utilization of the world are outlined. The rapid increase in the shares of liquid and gaseous energy carriers, relative permanency in the shares of the geothermal and hydroelectric power plants, and a decrease in the contribution of solid fuels in the overall energy budget are the principal features characterizing energy utilization. In 1970, the respective shares of petroleum, natural gas, and coal were estimated to be 46%, 20%, and 31%. Some two-thirds of the total electricity are generated in thermal power plants which create considerable air pollution problems. The respective shares of petroleum and natural gas as well as atomic energy within the overall energy generation in 1980 are estimated at some two-thirds and 4-7%. Oil shale will acquire increased importance as an energy carrier within the next decades.

34233 **APTIC NO. 57233**

United Technology Center, Sunnyvale, Calif.

STUDY OF SOLID ROCKET MOTORS FOR A SPACE SHUTTLE BOOSTER (FINAL REPORT. APPENDIX E: ENVIRONMENTAL IMPACT STATEMENT--SOLID ROCKET MOTOR SPACE SHUTTLE BOOSTER). *National Aeronautics and Space Administration Contract NAS8-28431, Data Requirement No. MA-02, Data Procurement Document No. 314, NASA-CR-123526, UTC 4285-72-7, N72-22798, 12p., March 1972.*

NTIS: CR-123526

The environmental impact of solid rocket motors for a space shuttle booster is described. The propellant combustion products that are emitted into the atmosphere include: aluminum oxide, carbon monoxide, hydrogen chloride, nitrogen, water, carbon dioxide, hydrogen, and ferrous chloride. The solids, alumina, and iron salt occur in natural dust rising from the weathering of rocks, and they are formed in particle sizes which are also typical of dust. The gases can be found as natural constituents in the earth's atmosphere. Dust and two of the gases, CO and HCl, can have adverse effects on man, animals, or vegetation if the concentration in the atmosphere is excessive. The HCl contained in the ground cloud resulting from each space shuttle launch does not constitute a significant pollution problem even under the most extreme conditions. Calculation of the degree of dilution with air at the point where the ground cloud touches the ground indicates that CO and HCl will be too diluted to constitute a hazard. (Author summary modified)

34234 **APTIC NO. 57483**

Gordian Associates, Inc., New York

THE COMPARATIVE ENVIRONMENTAL IMPACT IN 1980 OF FOSSIL FUEL SPACE HEATING SYSTEMS VERSUS ELECTRIC SPACE HEATING. *Electric Energy Assoc., New York, 115p., March 1972. 64 refs.*

The overall environmental impact in the United States of all fossil fuel space heating is compared to all electric space heating for residential applications. The air pollution emissions examined are total particulates, respirable particulates, benzo(a)pyrene particulates, sulfur dioxide, nitrogen oxides, carbon monoxide, hydrocarbons, and carbon dioxide. Based on total quantities of air pollution emissions from each residential space heating system, it is not immediately clear whether electric or the present mix of fossil fuels has a more adverse impact on the environment. For total heat emissions into land, water, and eventually the atmosphere, the electric residential space heating system appears to have a more adverse environmental impact. The fossil fuel space heating system would consume about 18% more fossil fuel natural resources than the electric system in satisfying 1980's residential space heating needs. From a conservation of economically useful resources viewpoint, as reflected by a resource utilization efficiency calculation, fossil fuel residential space heating has a more adverse impact on the environment. (Author summary modified)

34235 **APTIC NO. 57685**

Processes Research, Inc., Cincinnati, Ohio

AIR POLLUTION FROM FUEL COMBUSTION IN STATIONARY SOURCES. U. S. NATIONAL REPORT TO THE O.E.C.D. JOINT GROUP (FINAL REPORT). *Environmental Protection Agency Contract CPA 70-1, Task 19, EPA-R2-73-241, 111p., Oct. 1972.*

NTIS: PB 222341

Estimates of past (1968 and 1970) and future (1980) fuel consumption in stationary combustion sources are presented, along with associated quantities of the air pollutants (sulfur oxides, nitrogen oxides, and particulates) emitted to the atmosphere from the combustion of these fuels. Abatement strategies to control the 1980 level of pollutant emissions to alternative target levels, as obtained in 1968 and 1970 cases, are formulated and impressed on the 1980 situation. The projected emissions of sulfur and nitrogen oxides could be expected to approximately double the 1968 levels of pollution without the implementation of new controls. Particulate emissions would be expected to increase tenfold without the continued application of the best control practices. The 1980 emissions can be controlled to the targeted levels via the implementation of control and fuels management practices. The estimated costs for achieving control are appreciable, approaching a total estimated capital expenditure of about $13 billion (cumulative through 1980) and an annual operating cost of $2.8 billion by 1980 (1970 dollar estimates). Control methods include flue-gas cleaning combustion control, coal and oil desulfurization, and increased natural gas use. (Author abstract modified)

34236 **APTIC NO. 57689**

Processes Research, Inc., Cincinnati, Ohio, Industrial Planning and Research

SCREENING REPORT CRUDE OIL AND NATURAL GAS PRODUCTION PROCESSES. (FINAL REPORT). *Environmental Protection Agency Contract 68-02- 0042, Task 13, EPA-R2-73-285, 94p., Dec. 27, 1972. 71 refs.*

NTIS: PB 222718

Crude oil and natural gas are produced in 31 states of the United States. In 1971, there were 805 natural gas processing plants located in 34 different states and 290 counties. In 1969, there were about 520,000 producing oil wells and about 114,500 producing natural gas wells. A majority of these wells are located in 258 major oil fields and 38 major gas fields. There are about 3000 companies engaged in the production of crude oil and natural gas. It is estimated that, in the United States, between 7000 and 18,000 tons/day of hydrocarbons are emitted to the air in the production of crude oil and natural gas. The sulfur oxides emissions are estimated to be 20,000 tons/day, while sulfide emissions are estimated at 52 tons as equivalent hydrogen sulfide per day. The burning and emission of hydrocarbons in the field has been drastically reduced in recent years because of regulations by state conservation departments, and because it was to the economic advantage of the companies to recover such hydrocarbons. (Author summary modified)

1971

34237 APTIC NO. 57462

Dodgson, J., G. G. Hadden, C. O. Jones, and W. H. Walton

CHARACTERISTICS OF THE AIRBORNE DUST IN BRITISH COAL MINES. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 2:757-782, 1971. 14 refs. (Sept. 14-23.)*

A description is given of the composition and size distribution of airborne dusts from selected British coal mines. Histograms are given showing the overall variation in composition of the respirable dusts and the ashed respirable dusts during facework and stonework. Appreciable quantities of kaolin (11% on average) and mica (8%) were found in the dusts sampled during facework along with 4-5% quartz and lesser amounts of soluble minerals. Stonework dust contained respectively 30 and 40% more ash and quartz. The mean mineral compositions of the respirable dusts varied by as much as 4:1 between collieries and in a manner broadly correlated with rank of coal measured as carbon content. These relationships correlated for ash (correlation coefficient of -0.66) and quartz (-0.54). Percent kaolin correlated with rank (-0.88) but not % micra (-0.28). The relationship between quartz content of the ashed dusts and that of the rock strata was a mean ratio of 0.51 with a coefficient of variation of 27%. Routine size analyses gave the fractions of dust in the size ranges 1-2.5 micron, 2.5-5 micron, and greater than 5 micron. The effect of mining methods on size distribution was determined. A Coulter counter was calibrated for mass measurement. The total dust concentrations were three to eight times greater than corresponding concentrations measured directly with the MRE gravimetric sampler. The mass/number index (MNI) correlated inversely with the size parameter beta; was weakly inversely correlated to the % ash and noncoal; was correlated with coal rank; and ranged from 34.6 to 7.8 mg/cu m/1000 particles/cu m. There were more similarities in mean MNI between seams at the same colliery than differences. Frequently, differences in MNI at a colliery were due to different methods of mining coals; ash content, MNI, and mining operation were interrelated. Differences between particles in dusts with different MNIs were studied in a laboratory. Total dust measurements were made with MRE gravimetric dust samplers. Airborne dust concentrations measured with a Tyndalloscope II had a linear relationship with the mass concentration measured by the MRE sampler.

34238 APTIC NO. 57461

Jacobson, Murray

RESPIRABLE DUST IN BITUMINOUS COAL MINES IN THE U. S. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 2:745-756, 1971. 6 refs.*

Coal dust was collected in 29 large coal mines and some small mines with personal, portable, respirable dust samplers and with Isleworth gravimetric dust samplers developed at the Mining Research Establishment. Miners were equipped with personal samplers and other samplers were positioned in each section studied. Gravimetric samples were analyzed for dust concentration and ash, quartz, and iron content. The range and mean dust concentrations were correlated for the specific occupations of continuous mine operators and helpers, cutting machine operators and helpers, loading machine operators and helpers, shuttle car operators, and roof bolter operators. The dust concentration data for specific occupations described skewed distributions similar to that typical for the total data. A linear relationship was derived between personal gravimetric sampling data and data collected with the MRE sampler. The respirable dust exposure could be reduced when water and ventilation were adequately controlled.

34239 APTIC NO. 57239

Schuphan, Werner

POTENTIAL AND ACTUAL HAZARDS OF FERTILIZER AND PESTICIDE USE FOR THE ENVIRONMENT. *(Potentielle und reale Gefahren von Duengungsmassnahmen und Pestizideinsatz fuer die Umwelt). Text in German. Schriftenreihe Ver Wasser- Boden- Lufthyg. (Berlin), no. 34:35-50, 1971. 32 refs.*

A general ecologic model of the anthropogenic effects on the environment is presented, and the consequences of the use of fertilizers and pesticides are described. Dieldrin, lindane and DDT, once applied on the soil surface, partly evaporate due to their high vapor tension, and will be washed out by precipitation over areas where such pesticides had never been applied.

34240 APTIC NO. 57266

Shabad, L. M., A. P. Al nitskiy, Yu. L. Kogan, G. A. Smirnov, and N. P. Shcherbak

ON THE PRESENCE OF CARCINOGENIC HYDROCARBONS IN SOILS OF THE USSR. *(O kantserogennykh uglevodorodakh v pochvakh Sovetskogo Soyuza). Text in Russian. Kazan. Med. Zh., no. 5:6-11, 1971. 14 refs.*

Polycyclic aromatic hydrocarbons, and especially benzo(a)pyrene, levels were determined in soil samples from different parts of the USSR. Urban air, which accumulates combustion and exhaust gases; industrial emissions; motor vehicles, including aircraft; and certain preparations used for soil erosion control were sources of C2OH12 in the environment. Benzo(a)pyrene was detected in all soil and plant material samples investigated. The C20H12 levels were substantially higher in soil samples from urban and industrial areas as well as from highway belts than in such from rural areas. The C20H12 levels in soil samples from Moscow ranged from 70 to 346.5 micrograms/kg, and they were lowest in soil samples from Estonia with a minimum of 0.67 micrograms/kg. At a depth of 2.5 m, the C20H12 conente of the soil was 0.12 micrograms/kg. No relationship between the C20H12 concentration and soil depth, and between the C20H12 concentrations in soil and corresponding plant material was established. The background concentration in natural environments usually ranged from 1 to 2 micrograms/kg. The presence of C20H12 in all soil and plant material samples may be due either to the natural background level due to the assumed existence of endogenous sources, or to the effect of aircraft emissions.

34241 APTIC NO. 57354

Williams, M. R.

AIR TRANSPORT AND POLLUTION. *Preprint, National Society for Clean Air, Brighton, England, 20p., 1971. 23 refs. (Presented at the National Society for Clean Air Conference, Folkestone, England, Nov. 2-5, 1971.)*

Airport pollution by aircraft during the landing/takeoff (LTO) cycle of aircrafe is discussed. Smoke emissions have been eliminated by changes in the combustion system. Research on the identification of airport smell and fumes is being conducted. There are three more products of emissions classified as invisible products: nitrogen oxides, carbon monoxide, and unburned hydrocarbons. The distribution of these products during a typical LTO cycle is shown. The products associated with inefficient combustion constitute a major part of the emission. The LTO cycle used in the analysis has a typical duration of 20-22 min and for 90% of the time, the engines are idle and operating at 94 + or 4% efficiency. Another problem during LTO is fuel dumping which might total one pint/engine. Smoke trails are the objectionable problems of airport pollution. The pollution characteristics of a typical gas turbine engine are presented. Unburned hydrocarbons and carbon monoxide are most evident at idle, but almost disappear at high power. Carbon particulates (smoke) and nitrogen oxides tend to increase with power. The quantity of sulfur oxides is directly proportional to the fuel flow.

34242 **APTIC NO. 57584**

Bay Area Air Pollution Control District, San Francisco, Calif.

AVIATION EFFECT ON AIR QUALITY. *Dept. of Housing and Urban Development Contract P-386, Rept. ABAG-P-386-2.1F, Program Element 2, 172p., Feb. 1971.*

NTIS: PB 224683

Methods of identifying levels of contaminant emissions at San Francisco Bay Area airports were developed and applied to measuring present emissions and emissions under five future conditions. Methods were also developed for determining the probable impact of these emissions on surrounding areas. Emissions from five basic sources were considered: aircraft operations; engine overhaul and maintenance facilities; fuel handling, storage, and transfer; jet fuel dumping; and variation-related ground motor vehicles. Climatological conditions which determine the emissions distribution were identified for many localities within the area. Some localities are more sensitive than others to the introduction of air contaminants because of climatological features and their existing pollution situation. A guide which rates pollution potential (the probable reaction of a locality to any additional pollutants) was drawn up for use in the consideration of future airport sites.

1969

34243 **APTIC NO. 57563**

Garay, Paul N.

CONVENTIONAL POWER. *Sci. Technol., no. 87:20-27, March 1969.*

Proponents of nuclear power predict a dominant role for themselves in the future, but changes in our economy and developments in the fossil fuel industry may well modify their stand. Rising costs of proposed nuclear power stations is a definite detriment to development. The lower cost (16 cents/million btu) of nuclear fuel is offset by the high costs of preparation, handling, and disposal. The compactness of the fuel minimizes transportation costs, but improvements in transportation and utilization technology in fossil fuels will soon cut the present cost of 25 to 33 cents/million btu in half. Known reserves of uranium can meet fuel requirements only into the 1970 s, whereas recoverable coal reserves amount to some 830 billion tons. This is enough to supply requirements for the next 1300 years, at the present rate. Mechanization and strip mining have also reduced the costs of coal. Transportation costs will be reduced by using automated trains, cross-country conveyors, or slurry pumping, all of which are now in the development stage. The greatest problem with fossil fuels now is the emission of sulfur dioxide when burned. Varied solutions to the problem are offered. Most are costly, but some are at the break-even point.

1968

34244 **APTIC NO. 57168**

Caretto, L. S., R. F. Sawyer, and E. S. Starkman

THE FORMATION OF NITRIC OXIDE IN COMBUSTION PROCESSES. *Preprint, Combustion Inst., Central States Section, 30p., 1968. 13 refs. (Presented at the Combustion Institute, Central States Section, Technical Meeting on Pollution Problems Associated with Combustion, Columbus, Ohio, March 1968.)*

The principal oxide of nitrogen formed in the combustion process is nitric oxide. It is a high temperature product common to all combustion processes. Experimental data and equilibrium calculations for NO emissions are discussed. The NO samples from an ammonia/oxygen flame show that where concentrations are above equilibrium the reaction mechanism involves the formation of NO as an intermediate. Data for a combustion rig showed lower concentrations of NO than those for aircraft turbines. This is believed to be caused by the low inlet temperatures of the combustion rig. At high temperatures the important reaction leading to the formation of NO is: N2 + 0 equals NO + N. The decomposition kinetics of NO showed that, even at peak cycle combustion conditions in a spark ignition engine, the decomposition rates of NO were so slow that the expansion stroke would take place with no change in the amount of NO present. There are two difficulties in analyzing a combustion device. The combustion process is heterogeneous, and there is a constant addition of secondary air downstream from the primary combustion zone. It is necessary, therefore, to consider the kinetics invloved in both the primary and secondary combustion zones.

1967

34245 **APTIC NO. 57286**

Vogely, William A. and Warren E. Morrison

PATTERNS OF U. S. ENERGY CONSUMPTION TO 1980. *IEEE (Inst. Elec. Electron. Engrs.) Spectrum, 4(9):81-86, Sept. 1967.*

The importance of energy to the United States economic expansion and future trends of demand are explored with special emphasis on the role of utility electricity. It is estimated that by 1980 the total consumption of the nation will be 93 times 10 to the 18th power joules or approximately 63% greater than in 1965. The combination of energy resources required to meet total energy demands will continue to be a function of the separate demands of the major energy-consuming sectors (household and commercial, industrial, transportation, and utilities). Tables show the history and substitutability of various energy sources. It is hypothesized that major technological change can shift energy sources within markets regardless of the cost situation of the sources themselves.

1966

34246 **APTIC NO. 57252**

Bhaduri, Debdas

A THEORETICAL STUDY OF COAL DUST FLAME. *Indian J. Technol. (India), 4(11):322-326, Nov., 1966. 11 refs.*

A new method for the analysis of the combustion phenomenon in pulverized coal is illustrated. The method is based on the assumptions of a standard model of a premixed plane-flame whose characteristics are varied only along the flame length; the preignition period associated with the partial expulsion of volatile matter is not taken into consideration; coal dust contains spherical particles; coal dust is monodisperse in the absence of any particle size distribution; and the relative motion between particles and the surrounding medium is negligible. Based on the standard model, the burning of pulverized coal flame was represented by a system of differential equations formulated for the process of gasification in solid bed combustion system. Working formulas were derived for determining important flame characteristics, such as the flame length, degree of carbon burnout and concentrations of oxygen, carbon dioxide, and carbon monoxide along the flame length.

1965

34247 APTIC NO. 57254

Young, J. F.

FORECAST OF THE ENERGY FUTURE. *Preprint, 13p., 1965. 4 refs. (Presented at the American Power Conference, April 29, 1965.)*

Prospects for the future growth and development of energy resources and utilization are discussed. Increasing use of all five sources of energy (gas, oil, coal, hydrodynamic and nuclear power) is predicted. Trends are illustrated graphically.

1964

34248 APTIC NO. 57199

Dept. of Commerce, Washington, D. C., Bureau of the Census

FUELS AND ELECTRIC ENERGY CONSUMED IN MANUFACTURING INDUSTRIES: 1962. 1963 CENSUS OF MANUFACTURES. *Series M63(1)-6, 75p., July 1964.*

GPO

Statistics showing total fuel costs, quantity and cost of specified fuels, and the quantity and cost of electric energy are presented. The manufacturing industries consume a substantial portion of the coal, coke, fuel oil, gas, and electric energy produced in the U. S. These items are a source for heat and power and, except for electric energy, represent important raw materials for further manufacture. Data on total fuel cost and purchased electric energy for intercensal years 1950-53, 1955-57, 1959-62 appear in the annual survey of manufacturers volumes. For the years 1950-53, the statistics also contain the amount of electricity generated by manufacturing plants. A description of the samples, sampling techniques and coverage for these years is included in the annual survey reports. In addition to the fuel statistics, separate figures on the quantity and costs of electric energy purchased, generated and sold have been compiled. The statistics presented are reciprocal estimates obtained by inflating each establishment s reported data by its sample weight and adding the inflated figures.

1963

34249 APTIC NO. 57361

Juentgen, Harald

MEASUREMENTS FOR THE SULFUR BALANCE AND THE SO3/SO2 EQUILIBRIUM IN FLUE GASES. *(Messungen zur Schwefelbilanz und zum SO3-SO2-Gleichgewicht in Rauchgasen). Text in German. Erdoel Kohle (Hamburg), 16(2):119-125, 1963. 15 refs.*

A discussion of the thermodynamic and kinetic fundamentals, following results of tests for burning the sulfur to sulfur dioxide and sulfur trioxide in a test oil furnace are given. The establishment of a sulfur balance shows that immediately behind the combustion chamber the combustible sulfur is quantitavely found again as SO2 and SO3 in the flue gas. The sulfur burns to SO2 in the hot flame and is converted to SO3 in the presence of oxygen when being cooled. The equilibrium freezes at temperatures between 1000 and 1100 C, so that the conversion to SO3 in the gas phase depends only slightly on the temperature and in the presence of 1% of oxygen in the flue gas, is 1 to 3% compared with the total amount of SO2 and SO3. The conversion to SO3 increases in proportion to the square root of the oxygen content in the flue gas. The SO3 concentration is the product of the conversion of SO2 and the total content of SO2 and SO3, which decreases with increasing oxygen content. Consequently, the SO3 concentration steeply increases with rising oxygen content at the beginning and then runs through a flat maximum. The catalytically effected conversion to SO3 which occurs at the tube walls attached to the combustion chamber outlet could not be quantitatively defined, because in spite of heating up to over 300 C, the adsorption rate of sulfur or its oxides at the tube walls was continually changing. This rate was especially high in the presence of carbon black.

1960

34250 APTIC NO. 57380

Mullaney, George J.

NITROGEN OXIDE FORMATION IN AUTOIGNITION OF LIQUID FUEL SPRAYS. *Ind. Eng. Chem., 52(6):529-532, June, 1960. 13 refs. (Presented at the American Chemical Society, Division of Water and Wastes, Symposium on Air Pollution, 136th Meeting, Atlantic City, N. J., Sept. 13-18, 1959.)*

Formation of nitric oxide in the complex flame following autoignition of liquid fuel sprays was explored to find a way of suppressing its production in internal combustion engines. A shock-tube technique was used to provide a source of stationary, high pressure-high temperature air. Several liquid fuels were sprayed into the zone of compressed air after reflection of the incident shock wave from the tube end. A colorimetric technique was used to measure the nitrogen dioxide resulting from the nitrogen oxide which formed initially in the high temperature flame. Starting initially with a nitric oxide composition considerably less than equilibrium, nitric oxide formation will continue during the cooling period until equilibrium at a new lower temperature is reached. Decomposition will then begin. Calculations indicate that a maximum increase of 20 to 30% of nitric oxide could be expected for the cooling rate obtained with the experimental shock tube. By using a high air temperature (1100 K) before fuel injection to ensure a short ignition lag and changing the time of fuel injection, the duration of the combustion process could be controlled. Because of the exponential dependence of nitric oxide formation rate on temperature, the maximum temperature is probably the most important factor to be considered in studies of nitric oxide abatement.

1958

34251 APTIC NO. 57279

Harlow, W. F.

THE FORMATION OF SULPHURIC ACID IN BOILER FLUE GASES. *Trans. ASME (Am. Soc. Mech. Engrs.), 80:225-234, Jan. 1958. 14 refs. (Presented at the American Society of Mechanical Engineers, Annual Meeting, Nov. 25-30, 1956, Paper 56-A-159.)*

Tests have shown that the formation of sulfur trioxide from boiler flue gases is a surface effect which occurs mainly on the heating tubes, particularly the superheater, and that any SO3 formed in the combustion process is unimportant. The resulting sulfuric acid condenses on cooler surfaces, causing corrosion and deposits. Both metallurgical and chemical treatments to reduce the catalytic activity of the boiler tubes were tested. The most effective metallurgical coating was a aluminum-ethyl silicate which rendered the surface practically inert for 280 hours, after which is deteriorated until at 1480 hours its advantage had disappeared completely. A chrominizing treatment reduced catalytic activity to about one-third that of the untreated steel and lasted for 1475 hr. Stainless steel showed a reduction in activity to 1/16 that of mile steel, but ceased functioning at 400 hr. Chemical treatments included spraying the tubes with lime or a solution of commercial soda ash. The inhibiting effect of the lime failed after 24 hr. The soda-ash treatment lasted for 432 to 556 hr. The catalytic effect can be controlled or prevented for considerable periods by surface treatment of the tubes and, therefore, the acid formation is not an inherent feature of the combustion process, nor is its prevention an insurmountable problem.

1956

34252 **APTIC NO. 57562**

Kellogg, Herbert H.

EQUILIBRIUM CONSIDERATIONS IN THE ROASTING OF METALLIC SULFIDES. *J. Metals, vol. 206:1105-1111, 1956. 3 refs. (Presented at the American Institute of Mining, Metallurgical, and Petroleum Engineers, New York, Feb. 1956, Paper TP 4224D.)*

The introduction of the fluid-bed roaster, characterized by uniformity of temperature, gas composition, and calcine composition, has made it possible to calculate the equilibrium state of certain reactions in sulfide roasting. Roaster gas composition and sulfate conditions for copper sulfate formation in the calcine at temperatures below the dewpoint can be predicted, assuming that all of the roaster gas can come into equilibrium with all of the solid calcine. Slow reaction rates between the gas and solid will cause differences between theoretical and practical results. Since reliable thermodynamic data on the decomposition of iron sulfates are not available, the temperature regions for formation of iron sulfate cannot be calculated by the methods outlined for copper sulfate. The temperature regions for stability of the copper sulfates calculated are not unique for the copper sulfates; they are strongly dependent on the stoichiometry of the concentrate, roaster air, and total pressure. Reduced-pressure roasting would permit decomposition of copper sulfates at temperatures about 50 deg lower than at atmospheric pressure.

1955

34253 **APTIC NO. 57156**

Longwell, John P. and Malcolm A. Weiss

HIGH TEMPERATURE REACTION RATES IN HYDROCARBON COMBUSTION. *Ind. Eng. Chem., 47(8):1634-1643, Aug. 1955. 17 refs.*

Lean mixture blowout data from insulated spherical reactors suggest that the high temperature combustion of hydrocarbons in air is an overall reaction of 1.8 order with activation energy of 42 kcal/mole. No hydrocarbons are found in the combustion gases of incompletely burned mixtures. Large amounts of carbon monoxide are found and these, together with small amounts of hydrogen, can account for all the combustible material that has not yet burned. The slow and controlling step in kinetics limited high temperature combustion is the oxidation of carbon monoxide. Heat losses from the combustion zone reduce the limiting space heat releases by reducing the reaction temperature and thus the reaction rate. Since residual carbon monoxide and hydrogen account for all residual material the gas sample drawn into the probe is nearly homogeneous in composition. The work described is being continued to obtain more data on rich mixtures, to elucidate the reaction mechanism by detailed gas composition studies, and to investigate other variables such as inlet temperature and type of fuel.

1944

34254 **APTIC NO. 57546**

Hyde, Reed W.

SULPHUR DIOXIDE IN GASES FROM A DWIGHT-LLOYD MACHINE SINTERING A LOW-SULPHUR CHARGE. *Trans. AIME (Am. Inst. Mining Metallurgical and Petroleum Engrs.), vol. 159:94-96, 1944.*

Tests were run of Dwight-Lloyd machines sintering lead ores with low lead and sulfur content. Data were obtained from sintering lead sulfide flotation concentrates mixed with minus 20-mesh oxide ore with 16.8% Pb and 5.3% S content. Effects of wind-box vacuum were studied by making several runs over various vacuum ranges. In general, high SO2 concentrations were found in the early sintering stages followed by a rapid decrease in concentration, with relatively little SO2 in the gases from the last half or third of the operation. Sintering capacity of the machine decreased with a decrease in vacuum. The sinter cake made at 6 in. (H2O) was hard and strong, making an excellent blast furnace feed. At 2 in. vacuum, the sinter was markedly friable and of poor quality, showing lack of the heat concentration necessary to affect proper sintering. The 4 in. vacuum produced an intermediate-quality cake. Most favorable SO2 distribution in the wind-box gases for the utilization of S was obtained with a 6 in. vacuum. On a sintering machine with two wind boxes, gases from the first wind box at 6 in. vacuum would carry 89% of the SO2 as a 2.38% gas in 810 cu ft per sq ft of hearth area, as compared to 60% as a 2.75% gas in 480 cu ft for the 4 in. vacuum and 57.5% as a 2.35% gas in 500 cu ft for the 2-in. vacuum.

1930

34255 **APTIC NO. 57545**

Halferdahl, A. C.

REACTIONS BETWEEN IRON SULFIDE, SULFUR DIOXIDE, AND IRON OXIDES IN THE METALLURGY OF COPPER. *Ind. Eng. Chem., 22(9):956-963, Sept. 1930. 41 refs.*

Equilibrium equations for calculating the free energy of a reaction involving the title substances can be applied to the reduction of magnetite by ferrous sulfide at temperatures above 1300 C. A reverberatory furnace is suggested for accomplishing quick and complete reduction of magnetite in copper converter slag. If poured from a height, hot converter slag should penetrate any layer of slag to mix intimately with the equally hot iron sulfide of the matte pool. Time of contact will be longer than in a side-bed furnace. Increased liquidity of the drag will permit more settling of the matte prills. In copper blast furnace smelting, a charge of coke, low grade iron sulfide, and limerock should produce temperatures necessary to flux silicates and prevent an excess of magnetite from forming. At 132 C the reaction 3Fe3O4 + FeS equals 10FeO + SO2 has a free energy value of zero and a sulfur dioxide pressure of 1 atm. At 1400 C the free energy is 5300 cal.

CONTROL METHODS

1974

34256 **APTIC NO. 57704**

Capes, C. Edward, Allan E. McIlhinney, Douglas S. Russell, and Aurelio F. Sirianni

REJECTION OF TRACE METALS FROM COAL DURING BENEFICIATION BY AGGLOMERATION. *Environ. Sci. Technol., 8(1):35-38, Jan. 1974. 10 refs.*

Six coals from different geographical locations were tested for trace heavy metal quantities during fine grinding followed by selective oil agglomeration of the carbonaceous constituents. Atomic absorption spectrophotometry was used for the heavy metals wherever possible because of the better precision it provided. Optical emission spectroscopy and spark source mass spectroscopy were used for metals present in lower concentrations. The level of most heavy elements was generally low but, in light of the large throughputs of power plants, the potential environmental hazard may be significant, especially for those elements which are volatile or may form volatile compounds when fired. Many of the trace metals were substantially removed during agglomerative beneficiation of the coal. Some which were in organic association in the coal remained in the agglomerated product. In addition to the reduced environmental hazard, a number of other advantages in upgrading coals prior to use are discussed. (Author abstract modified)

34257 **APTIC NO. 57706**

Cochran, C. Norman

RECOVERY OF HYDROGEN FLUORIDE FUMES ON ALUMINA IN ALUMINUM SMELTING. *Environ. Sci. Technol., 8(1):63-66, Jan. 1974. 17 refs.*

The adsorption of hydrogen fluoride fumes from aluminum smelting on alumina was studied. Calcined aluminas with widely ranging surface areas rapidly chemisorbed a monolayer of HF at partial pressures of a few micron in Al smelting fumes at 120 C. The chemisorbed layer contained two HF molecules/surface Al2O3 molecule and converted aluminum fluoride to a crystal above 300 C. Additional HF physisorbed at higher partial pressures was mostly desorbed on heating above 120 C. Adsorption isotherms were derived from data for processes in which the fumes were contacted with calcined Al2O3 for recovery of fluorides. The fluoride containing Al2O3 was fed to the Al smelting cell for electrolysis to close the fluoride fume generation and recovery loop. This lowered the AlF3 requirements of Al smelting to essentially that for converting the sodium oxide impurity (introduced with the Al2O3) to a fluoride bath of the desired composition. The HF was generated near the 975 C smelting temperature by reaction of AlF3-containing species with moisture. The reverse reaction favored at lower temperatures was the basis for the recovery process. (Author abstract modified)

34258 **APTIC NO. 57521**

Fraser, Malcolm D. and Gary J. Foley

A PREDICTIVE PERFORMANCE MODEL FOR FABRIC FILTER SYSTEMS. I. INTERMITTENTLY CLEANED SINGLE-COMPARTMENT SYSTEMS. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 3p., 1974. (Presented at the Air Pollution Control Association, Annual Meeting, 67th, Denver, Colo., June 9-13, 1974.)*

A performance model was developed for a single compartment fabric filter. The model assumes that the filtering layer consisting of dust and fabric can be thought of as a tangled mass of fibers of various diameters. Particle collection results in the growth of fiber-like particle filaments attached to the fibers which then act as fibers. The general type of theoretical collection equations for diffusion, interception, and impaction then apply. The model is the first complete computerized model for a fabric filter system. Collection efficiency is described by equations for clean filters and dirty filters. A standard equation is included to describe the pressure drop as a function of time and of two important coefficients -- the effective drag of the fabric after cleaning and the dust-fabric resistance coefficient. The model predictions are compared with limited available data. A set of data for collection of fly ash on a variety of fabrics was used to show that the model can predict the general effect of fabric type on performance.

34259 **APTIC NO. 57700**

George, Herman F. and Gary W. Poehlein

CAPTURE OF AEROSOL PARTICLES BY SPHERICAL COLLECTORS. ELECTROSTATIC, INERTIAL, INTERCEPTION, AND VISCOUS EFFECTS. *Environ. Sci. Technol., 8(1):46-49, Jan. 1974. 9 refs.*

The collection of aerosol particles smaller than 10 micron is important in air pollution control. A mathematical model is presented to predict the efficiency of the capture of aerosol particles by spherical collectors. This model considers inertial, viscous, gravity, and electrostatic forces, and the interception phenomena. The model shows that the efficiency of collection can be improved by the presence of electrostatic charges on the particles. The model, based on potential flow around the collector, is written in dimensionless form. Model predictions are plotted in terms of the appropriate dimensionless groups and are compared with previous works that considered electrostatic and viscous forces separately. (Author abstract modified)

34260 **APTIC NO. 57759**

Nannen, L. W., R. E. West, and F. Kreith

REMOVAL OF SO2 FROM LOW SULFUR COAL COMBUSTION GASES BY LIMESTONE SCRUBBING. *J. Air Pollution Control Assoc., 24(1):29-39, Jan. 1974. 29 refs.*

An analysis of the limestone scrubbing process for sulfur dioxide removal was carried out. The basic process chemistry and absorption-rate steps controlling the mass transfer of SO2 are discussed. Criteria for scrubber selection are presented, and various scrubber types are compared and evaluated for application to limestone scrubbing. Venturi spray tower, fixed bed, and mobile bed (including turbulent contact absorber) scrubbers are compared. A summary of the effects of SO2 concentration on the scrubbing process is given. Basic design variables for a 100 megawatt plant burning low sulfur coal are specified. The low concentrations of SO2 in power plant flue gas (less than 1000 ppm) tend to minimize the solid-liquid mass transfer resistance, and the SO2 absorption process approaches gas phase control. Gas phase control has a favorable effect on the important parameters of limestone blinding, scaling, slurry pH stability, sulfite oxidation, solids settling, and slurry recirculation rate. The operational reliability increases for lower SO2 gas concentrations. (Author abstract modified)

34261 **APTIC NO. 57729**

Quillman, B. and C. W. Vogelsang

CONTROL OF PARTICULATE AND SO2 EMISSIONS FROM AN INDUSTRIAL BOILER PLANT. *Bldg. Systems Design, 71(1):185-189, Dec.-Jan. 1974. (Presented at the American Society of Mechanical Engineers Industrial Power Conference, Louisville, Ky., May 14-20, 1973, Paper 73-IPWR-5.)*

Determination of the most economical route to control industrial boiler plant particulate and sulfur dioxide emissions for a specific site requires an in-depth analysis of the factors applicable to that site. The major factors are fuel cost and availability, how they are expected to vary with time, the confidence of the forecast, and the relative technical risk of pollution control alternative selection. Natural gas and No. 2 oil, when gas is not available, is the preferred route so long as current price and availability forecasts hold. The most economic alternative to natural gas and No. 2 oil is 0.7% sulfur-content coal using either bag filters or electrostatic precipitators, if the fuel price differential between low and high sulfur coal holds as forecasted. Further, SO2 control is entirely dependent upon an assumed 10-year supply of 0.7% S coal. Tail-end limestone flue gas scrubbing offers the greatest potential on an annual operating cost basis. However, investment is high and risk is great as system reliability has not been demonstrated. This should be the preferred route because it makes possible the use of our most abundant fuel resource. However, more demonstrations of technology are required before the investment risk is reasonable. The following program has been adopted to prepare for the time when natural gas is not an available boiler fuel: continue with natural gas and No. 2 oil as long as possible, maintain an on-going program to determine if flue gas scrubbing is practical, and stay intimately familiar with all changes in fuel prices and availability. (Author summary)

1973

34262 **APTIC NO. 57130**

Abe, Masaki, Yutaka Tanaka, Noboru Yoshino, and Kazuo Koshino

EFFECTS OF THE DELAY OF THE SPARKTIMING AND THE CONTROLLING DEVICES OF THE SPARKTIMING. *(Tenka jiki chosei oyobi tenka jiki seigyo toritsuke ni yoru haishutsu gasu gensho koka ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3): 336, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 81.)*

Representative makes of Tokyo automobiles were used for testing the effects of spark timing delay and control devices on the amount of exhaust gases and their effects on performances. The reduction effect of a spark timing control device on 4-mode driving fluctuated greatly depending on individual car, but the average of 13 cars for nitrogen oxide was 24% reduction and for hydrocarbons was 4%. There was very little effect on carbon monoxide emission, either by spark timing delay or control device. When spark timing was delayed, NOx decreased 16% (18-car average), but there was no effect on the amount of HC. Fuel consumption increased for idling and 80 km/hr driving; and acceleration power decreased from 0 to 400 m, and 40 to 60 km/hr, but the differences were not significant.

34263 **APTIC NO. 57294**

Al tshuler, V. S.

REMOVAL OF SULFUR DIOXIDE FROM GASES. *(Ochistka gazov ot sernistogo angidrida). Text in Russian. Khim. Tekhnol., no. 4:5-13, 1973. 43 refs.*

Methods for the removal of sulfur dioxide from flue gases, with and without subsequent recovery and recycling of SO2, are reviewed. Scrubbing waste gases with water for SO2 removal has the advantages of high water expenditure and the need for additional water treatment. Flue gas scrubbing with slightly alkaline water is employed in Great Britain. Flue gas scrubbing with limestone or slaked lime has an efficiency of 85-95%. A combination of lime with ammonia has an efficiency of 95%. Dolomite, and especially limestone dust with traces of iron, are suitable for the adsorption of SO2 in flue gases. Another ammonia process yields ammonium disulfite which under regeneration releases SO2 suitable for recovery. The ammonia-acid process has an efficiency of 85-95%, and yields concentrated SO2 and ammonium sulfate. The magnesite process uses a watery suspension of magnesia for the adsorption of SO2, and the resulting magnesium sulfate is thermally regenerated to yield concentrated SO2 and magnesia. The Grillo-AGS process uses magnesium and manganese hydroxides for the removal of SO2 at a rate of 90%. Xylidine, dimethylaniline, and tributylphosphate are suitable as adsorbents only for relatively high SO2 concentrations. The Reinluft process uses a carboniferous sorbent which on thermal regeneration releases concentrated SO2. The Lurgi process, using catalytically activated carboniferous sorbent, produces dilute sulfuric acid. Another dry process uses soda-aluminate as the sorbent, and hydrogen or carbon monoxide for regeneration for liberation of the adsorbed SO2 in the form of hydrogen sulfide. Dilute sulfuric acid is obtained in an acid-catalytic processes in which SO2 is directly oxidized by means of manganese, iron, or copper ions in water.

34264 **APTIC NO. 57285**

Bertrand, R. R., R. C. Hoke, H. Shaw, and A. Skopp

COMBUSTION OF COAL IN A BED OF FLUIDIZED LIME. *Am. Chem. Soc., Div. Fuel Chem., Preprints, 18(4):25-29, 1973. 2 refs. (Presented at the American Chemical Society, National Meeting, 166th, Chicago, Ill., Aug. 26-31, 1973.)*

A regenerative limestone process for fluidized bed coal combustion and desulfurization is described. The fluidized bed combustor potential for air pollution control is good because the intimate gas-solid contacting in the bed promotes high sulfur dioxide removal efficiency on suitable materials such as limestone or dolomite. Factors influencing the reduction of nitrogen oxide emissions in fluidized bed combustion and regeneration of sulfate lime at pressures up to 10 atm were studied. As temperature decreased, nitric oxide emissions decreased. Actual NO emissions decreased as excess air increased. When the emissions were normalized to a constant gas volume at 3% oxygen, the NO emissions increased as the excess air increased. Calcium sulfate bed material gave lower NOx emissions than alundum. With a calcium oxide bed, the emissions were high initially, but as the bed sulfated, the emission level approached that of CaSO4. One consistent explanation for these results is the reaction of NO with carbon monoxide. The CO emissions were higher at lower temperatures and at lower excess air conditions. The higher CO levels then gave lower NO emissions. The bed materials caused a catalytic effect. The reaction of CO and NO was studied further in fixed bed units, as was the reaction of NO and SO2. The reactions of NO with CO suggest that NO emissions can be lowered by operating at two-stage combustion system.

34265 **APTIC NO. 57338**

Campbell, K.

EXHAUST FILTRATION SYSTEMS: THEIR EFFECT ON PARTICULATE EMISSIONS AND NOISE LEVELS. *SAE-Australasia, 33(5):198-203, Sept.-Oct. 1973. 8 refs. (Presented at the Society of Automotive Engineers of Australia, National Convention, 73rd, Nov. 1, 1973, Paper 21.)*

The effect of exhaust filtration systems on particulate emissions and noise levels in gasoline engines is discussed. The particulate emissions of the gasoline engine are criticized because of their lead content due to the Pb added to the gasoline to raise its octane number. Filtration systems based on alumina-coated stainless steel wire and effective in reducing vehicle Pb emissions were developed. Reductions in Pb emissions of over 60% can be achieved with exhaust filtration systems. There is no increase in noise levels as compared to standard exhaust systems. Filters are being designed that reduce undesirable the increase in back pressure with no additional space requirements. The alumina filters are equally as effective in reducing carbon emissions as they are in reducing Pb emissions, and they are being currently tested on diesel exhausts.

34266 **APTIC NO. 57688**

Chang, Jeffrey Chin-Yee

THE KINETICS OF THE CATALYTIC OXIDATION AND HETEROGENEOUS SULFATION OF SULFUR DIOXIDE AT LOW CONCENTRATION. *Pennsylvania State Univ., Dept. of Chemical Engineering, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1973, 222p. 88 refs.*

The applicability of various mixed metal oxides for the recovery of sulfur dioxide from simulated flue gas was investigated. Chromium-tin oxide, copper oxide-cement, copper oxide-chromium oxide, and copper oxide coats on activated bauxite were prepared in the laboratory and selected for study on the basis of their semiconducting and thermodynamic properties and low cost. Kinetic studies of the oxidation of SO2 were performed in an isothermal tubular reactor at various temperatures and feed compositions. The chromium-tin oxide catalyst was found effective for the conversion of SO2 in air to sulfur trioxide at temperatures above 290 C and thus applicable for the recovery of flue gas SO2. Copper oxide reacted with SO2 in the presence of oxygen and indicated its feasibility for recovering SO2 from flue gases in the form of a solid sulfate at temperatures higher than 300 C. Kinetic data for the catalytic oxidation of SO2 on the Cr2O3-SnO2 catalyst at 390, 403, and 416.8 C indicated that the rate-controlling step was the surface reaction between a chemisorbed SO2 and a chemisorbed oxygen atom to give a gaseous SO3 or a chemisorbed SO3 with a very high desorption rate. The Cr2SnO2 catalyst was found to be less dependent on temperature and more active at temperatures below 350 C than commercial vanadium pentoxide. (Author summary modified)

34267 **APTIC NO. 57246**

Chien, M. W. and Ken Nobe

REDUCTION AND ADSORPTION KINETICS OF NITRIC OXIDE ON MIXED COBALT OXIDES. *Am. Chem. Soc., Div. Petrol. Chem., Preprints, 18(3):461-465, Aug. 1973. 3 refs. (Presented at the Symposium on Catalytic Approaches to Environmental Control, Chicago, Ill., Aug. 26-31, 1973.)*

The catalytic reduction of nitric oxide could be used as a method of controlling nitrogen oxide emissions from automobiles and stationary sources. The reduction and adsorption of nitric oxide on lanthanum cobalt oxide (LaCoO3) and a number of other perovskite mixed cobalt oxides were studied. The kinetics of NO reduction with carbon monoxide in nitrogen carrier gas in a fixed bed, flow integral reactor was investigated. In general, the conversion of NO by CO on mixed cobalt oxide catalyst decreased with increasing initial concentration of NO. Variation of initial CO concentration had very little effect on the reaction rate. Nitrous oxide was formed in the low temperature range and nitrogen dioxide was not detected. Material balances were performed with the data for La(0.85)Ba(0.15)CoO3 catalyst between 100 and 500 C. The results indicated NO was reduced by CO to N2O and/or nitrogen. During the adsorption kinetic experiments, activated surfaces were better adsorbents and more active catalysts than unactivated surfaces.

34268 **APTIC NO. 57334**

Conn, A. L.

LOW B.T.U. GAS FOR POWER PLANTS. *Chem Eng. Progr., 69(12):56-61, Dec. 1973. 35 refs.*

The production of low B.t.u. gas from high sulfur coal for power plants is discussed. The gas is produced under reducing conditions, with the result that sulfur is converted to hydrogen sulfide which can readily be removed by absorption. The gas can be generated under pressure, permitting some operating economies in an existing power plant, and more advanced power plant design for a new plant. Only the Lurgi process has been commercialized and is operating successfully in 14 plants. At least seven different atmospheric pressure processes have been developed which can be classified into three general types: fluidized bed, fixed or settling bed, and entrained bed. Among the new ideas which are still in conceptual stages are a fast fluidized bed, the agglomerating bed, gasifying coal in a molten bed of iron, an entrained bed gasifier, and a moving bed oxygen-blown gasifier using lime for gas cleanup.

34269 **APTIC NO. 57335**

Elston, John C.

CRITERIA FOR EVALUATING VEHICLE IN-USE INSPECTION/MAINTENANCE IMPACT OF EMISSIONS AND ENERGY CONSERVATION. *Energ. Automob., 1973:54-57, July 1973. 27 refs.*

Vehicle in-use inspection/maintenance programs and their impact on emissions and energy conservation are discussed. Emission surveillance and service data illustrate the effect of the New Jersey inspection program with emphasis on minimizing the impact to the motoring public. Maximum emission reduction yields of 10-12% are expected for carbon monoxide and hydrocarbon emissions. An additional 0.33% fuel saving could be realized. Of the 667,970 cars tested in the first 6 mo of the program, 80,658 or 12% failed to meet standards and needed only minor adjustments to comply, at a lower cost. Other vehicles were rejected for a variety of problems and were more costly to adjust. (Author abstract modified)

34270 **APTIC NO. 57610**

Epstein, M., L. Sybert, S. C. Wang, C. C. Leivo, and F. T. Princiotta

LIMESTONE TEST RESULTS AT THE EPA ALKALI WET-SCRUBBING TEST FACILITY AT THE TVA SHAWNEE POWER PLANT. *Preprint, American Inst. of Chemical Engineers, 85p., 1973. 8 refs. (Presented at the American Institute of Chemical Engineers, Annual Meeting, 66th, Philadelphia, Pa., Nov. 11-15, 1973.)*

A prototype lime and limestone wet scrubbing system for removing sulfur dioxide and particulates from flue gases was integrated into the flue gas ductwork of a coal-fired boiler at the Tennessee Valley Authority Shawnee Power Station, Paducah, Kentucky. The test facility consisted of three parallel scrubber systems: a venturi followed by a spray tower; a turbulent contact absorber (TCA); and a marble-bed absorber. Each system was capable of treating approximately 10 Mw equivalent (30,000 acfm at 300 F) of flue gas containing 2300-3300 ppm sulfur dioxide. The results of air/water testing, sodium carbonate testing, limestone wet-scrubbing testing, and lime wet-scrubbing testing are presented. Short-term factorial limestone tests were conducted at high scrubber inlet liquor pH (6.0-6.2). Series operation of the venturi and spray tower removed 80% of the SO2; the TCA scrubber removed 96% SO2; and the marble-bed absorber removed 80% SO2. Three long-term reliability verification tests were run at pH 5.7-5.9 and at reduced stoichiometric ratio, in order to increase system reliability and limestone utilization. For the TCA system, limestone utilization was 83% with a SO2 removal of 80-85% and a pressure drop of 7 in. water. The operability and reliability of the scrubber systems were good. There was little sulfate or sulfite scale after 500 hr of operation of all three systems, with effluent residence times greater than 20 min and percent solids recirculated greater than 10% (40% of the solids are fly ash).

34271 **APTIC NO. 57328**

Fekete, Sanor

LABORATORY INVESTIGATIONS CONCERNING THE SEPARATION AND RECOVERY OF SO2 FROM INDUSTRIAL WASTE GASES. *(Ipari hulladekgazok SO2-tartalmanak levalasztasara es hasznositasara vegzett laboratoriumi vizgalatok). Text in Hungarian. Banyasz. Lapok, 106(7):461-467, 1973. 10 refs.*

Large-scale laboratory experiments on the separation and recovery of sulfur dioxide from industrial waste gases generated by sulfuric acid manufacturing plants and power plants by means of manganese ores slurries with simultaneous attack and recovery of manganese dioxide from such ores are described. A 4 to 1 mixture of a slurry of carbonate and oxide Mn ores was attached by power plant-generated flue gas containing 0.4% of SO2 by volume, and a Mn recovery rate exceeding 90% was achieved. The Mn ore was converted into manganese sulfate by SO2, and also H2SO4 was formed at the same time. A hydrometallurgical pilot plant with a foam column was built for the extraction of Mn from Mn ores in the form of manganese oxide at a recovery rate of about 90%, by means of flue gases containing an average of 0.35% SO2 which is removed in this process at a rate of 85-90%. The first, attacking stages yields Mn SO4.4H2O in a concentration of 10 to 80 g/l Mn, after which Mn SO4.4H2O is converted into MnO by drying and calcination in a second stage. The product obtained contains some 60% of MnO, suitable for metallurgical processes. The cost of power plant flue gas desulfurization amounts to 31 Ft per ton of coal fired. In general, Mn ore process of flue gas desulfurization can be used in H_2SO_4 manufacturing plants for the production of crystalline $MnSO_4.4H_2O$, as well as in power plants for the recovery of SO_2 in the form of ammonium sulfate fertilizer, and for the production of MnO concentrates.

34272 **APTIC NO. 57611**

Foley, G. J., G. T. Rochelle, W. R. Schofield, and J. O. Smith

CONTROL OF SOX EMISSIONS FROM INDUSTRIAL COMBUSTION. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., Control Systems Lab., 19p., 1973. 3 refs.*

Sulfur oxide emissions from industrial combustion account for approximately 16% of the total stationary source SOx emissions. Since industrial boilers have shorter stacks than utility boilers, they contribute 1/3 of the urban ground level ambient SOx from combustion. Control technology with near-term potential for controlling SOx from industrial combustion primarily consists of fuel gas cleaning and the use of clean fuels. Data from the National Emissions Data Bank was used to characterize industrial coal-fired boilers. The median industrial coal-fired boiler capacity is approximately 6.25 times 10 to the 10th power calories/hr. The average plant contains two or three such boilers, so that the median plant capacity is approximately 1.75 times 10 to the 11th power calories/hr. Thus, flue gas cleaning will probably be economically applicable to a significant portion of the industrial combustion sector, especially if the plant layout permits the installation of one cleaning system for most of the boilers in a given plant. An economic evaluation indicated that flue gas cleaning could be applied potentially to half of today s installed industrial coal-fired boilers at costs less than the minimum projected costs of synthetic clean fuels from coal. Considering the effect of load factor, control of this fraction of capacity would result in control of 3/4 of the coal consumption in industrial combustion and therefore of 60-70% of the SOx emissions, depending on removal efficiency. This could reduce ground level SOx by 17%. Two future projections of fuel consumption by the industrial sector were used to forecast the future need for control technology. Industrial coal consumption will increase by only 50% in one projection and triple in the other by 2000. The first projection shows a major shift from fossil fuels to electricity so that industrial combustion will not grow much in the next 30 years. The second projection shows uniform growth so that there will be three times as much industrial combustion in 2000 as today.

34273 **APTIC NO. 57317**

Forgo, Laszlo

GENERATION OF ELECTRICAL ENERGY AND ENVIRONMENTAL PROTECTION IN HUNGARY. *(Villamosenergia-termeles es kornyezetvedelem Magyarorszagon). Text in Hungarian. Musz. Tud., 46(3-4): 335-342, 1973.*

Problems of air pollution abatement in the electricity generation area in Hungary are discussed, and modern methods of air pollution control are presented. Air-cooled condensation, though requiring a higher investment than other types of cooling equipment, is regarded as the best method of cooling in thermal power plants from an environmental point of view. The clean air discharged from such cooling towers, about 20 C warmer than the ambient air, ascends to great altitudes. This vertical air stream is also suitable for lifting power plant-generated waste gas emissions to high altitudes if the stack is installed in the center of the air-cooling tower. Such thermal lift is especially essential during inversion periods which occur rather frequently in Hungary. Such emission streams are able to penetrate through inversion layers several hundred meters thick.

34274 **APTIC NO. 57695**

Gresens, H.

ENVIRONMENTAL PROTECTION - VENT AIR TREATMENT IN TEXTILE FINISHING. *(Umweltschutz - Abluftreinigung in der Textilveredlung). Text in German. Text.-Prax., no. 9:508-509, 1973.*

Emission components usually occurring in vent air from textile finishing facilities are surveyed, and possible ways of solution control in the textile finishing industry are described. Dyes subliming at the high temperatures required for thermfixation; carrier residues responsible for odor nuisances, such as orthophenylphenol and esters, and brighteners, containing such substances as mineral oil, emulsifiers, glycerides, phosphatides of fatty acid esters, and possibly fatty acid ethyleneoxide adducts, are the principal substances present in the vent air from textile finishing shops. Vent air incineration, either thermal or catalytic, is unsuitable for the destruction of such emission components due to the very large volume of air to be treated. Low-temperature condensation of the vent air compounds, though effective, is not used outside the U.S.A. on account of the high energy costs involved. Scrubbing with water, though not especially suitable for the removal of phenol compounds, is the economically best solution as yet for the treatment of vent air from textile finishing shops.

34275 **APTIC NO. 57234**

Hegedus, L. Louis

EFFECTS OF CHANNEL GEOMETRY ON THE PERFORMANCE OF CATALYTIC MONOLITHS. *Am. Chem. Soc., Div. Petrol. Chem., Preprints, 18(4):487-502, Aug. 1973. 4 refs. (Presented at the Symposium on Catalytic Approaches to Environmental Control, Chicago, Ill., Aug. 26-31, 1973.)*

Catalytic monoliths can be used to oxidize unburned hydrocarbons and carbon monoxide in automotive exhausts. Geometric shape of the monolith channels can influence the conversion of oxidizable emissions and the pressure drop in the monoliths. In this theoretical study of the effect of shape on oxidation, a completely mass transfer limited process was assumed. Conversion in mass transfer inhibited tubular reactors with catalytic walls was studied. Laminar boundary layers were developed in ducts of various shapes; the design of monolithic reactors for a given conversion was determined; the pressure drop across the monoliths was determined; the effect of channel size on the performance of square channeled monoliths was analyzed; and the effect of the geometric shape of the channel cross section on the performance of catalytic monoliths was studied. At constant finished diameter of the monolith, channels of elongated rectangular cross sections are preferable to ellipses, hexagons or cyclinder, squares and equilateral triangles or sinusoids, in that sequence. Proper selection of the channel geometry and the channel size allows significant savings in the size and weight of the monoliths at constant catalytic performance. While no absolute optima were shown, the practical combinations of channel shape, feed flux, and channel dimension can be selected for a given conversion to construct improved monoliths. No mechanical or thermal stress arguments were considered.

34276 **APTIC NO. 57307**

Holm, Ake

JET ENGINES IN THE SERVICE OF CLEAN AIR MAINTENANCE. *(Jetmotorteknik i luftvardens tjanst). Text in Swedish. Kem. Tidskr., no. 11:42-47, 1973. 3 refs.*

High-temperature flame reactors, adopting the jet engine principle, and low-temperature catalytic reactors, both developed and manufactured by Volvo Flygmotor AB for the destruction of gaseous emissions in general and of malodorous gases in particular, are described. The high-temperature combustion chamber provides high-intensity incineration of the waste gases in a temperature range around 800 C at an efficiency of 95-100%. The gas flow rate is maintained between 20 and 40 m/sec. Low-temperature catalytic reactors operate in a temperature range of 300-400 C, and use granulated or honeycomb-shaped silica or alumina as catalyst support.

34277 **APTIC NO. 56974**

Inoue, Koichi, Kunio Yoshizumi, Kuniko Oguchi, and Toshio Odaira

THE DELAY OF THE SPARK TIMING. *(Tenka jiki no chien ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):334, Oct. 1973. (Presented at the Japan. Society for Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 79.)*

The effect of delayed spark timing on the composition of exhaust gas and engine performance was examined. Three domestic cars, two with 2000 cc exhaust capacity and one with 1600 cc exhaust capacity were run on a chassis dynamo and engine dynamo. The cars had either a spark timing adjustment or an ignition gap control device. The gases were measured by the direct method of the CVS method, and analyzed by non-dispersion infrared analyzer, non-dispersion ultraviolet analyzer, and flame ionization detector. The effects of these devices were almost nil on the amount of hydrocarbons, and the effects on nitrogen oxides were 7-29%. The hydrocarbon, nitrogen oxide, and carbon monoxide levels measured by the CVS method on 10 modes and 8 modes of driving showed no effects but the direct measurement of 4 modes showed a reduction effect. The increase of suction air by control of ignition gap or delay of spark timing is 0.9 to 6.7%. As to the effect on engine performance, there was a 2-3% increase of fuel composition; the loss of acceleration was recognized somewhat, initially, and the rise of exhaust temperature was recognized. Although the effects were somewhat lost with driving at varied speed, the control of ignition gap would be more effective than the adjustment of spark timing.

34278 **APTIC NO. 57242**

Johnson, D. W., Jr. and P. K. Gallagher

STUDIES OF SOME PEROVSKITE OXIDATION CATALYSTS USING DTA TECHNIQUES. *Am. Chem. Soc., Div. Petrol. Chem., Preprints, 18(4):477-481, Aug. 1973. 6 refs. (Presented at the Symposium on Catalytic Approaches to Environmental Control, Chicago, Ill., Aug. 26-31, 1973.)*

The catalytic oxidation of carbon monoxide and hydrocarbons is of considerable interest because of the problems associated with automotive emissions. Differential thermal analysis (DTA) was used in its normal dynamic mode toscreen potential unsupported catalysts from the system lanthanum sub 1-x metal sub x manganese oxide, where metals equal lead, calcium, strontium, or barium which are generally active catalysts. A number of other materials having perovskite crystal structure were studied. The materials were tested for their ability to oxidize 1% hexane in air; occasional comparisons were made using 3% CO in air. Since neither of these gaseous mixtures is at all similar to actual automobile exhaust but are convenient to demonstrate the suitability of DTA techniques for screening potential catalysts, the results should not be extrapolated to indicate performance under actual conditions. In the series La sub 1-x metal sub x MnO3, the catalytic activity for the oxidation of hexane and CO followed the order of Ba approximately Sr approximately Ca greater than Pb. The activity was only a minor function of x within the constraints of the perovskite phase. The acid treatment increased the surface area and enhanced the catalytic activity. In the test oxidizing atmospheres, these beneficial effects were destroyed by subsequent thermal treatments at higher temperatures. Stronium substituted materials were more resistive to deactivation materials under these conditions. Under the DTA conditions where the atmosphere passed over rather than through the sample, the entire surface area of the material was not available or effective. However, the surface area of the sample was still an important factor in its apparent activity. The sample preparation technique was not important other than through its effect on the attainable catalyst surface area. The activity and stability were not optimized, and a more detailed investigation using supported samples and more conventional evaluation techniques is proceeding. (Author conclusions modified)

34279 **APTIC NO. 57692**

Jongebreur, A. A.

SOME POSSIBLE WAYS OF ABATING ODOROUS EMISSIONS FROM CATTLE RAISING FACILITIES. *(Enkele mogelijkheden tot het terugdringen van de stankoverlast veroorzaakt door de veredelingsbedrijven). Text in Dutch. Ingenieursblad, 42(20:552-556, 1973. 13 refs.*

Some possibilities of controlling malodorous emissions in cattle-raising facilities, and especially in pigsties and poultry houses, are described. The air in pigsties was repeatedly found to contain ammonia, methane, hydrogen sulfide, ethanal, propanal, butanal, hexanal, acetone, 2-butanone, 3-pentanone, methylamine, ethylamine, triethylamine, propylamine, isopropylamine, and pentylamine. Deodorants, such as Alamask CPM-NX, Peach Blossom, and Stalfris are suitable for masking and possibly neutralizing malodorous substances in the air. Ozonization, requiring even distribution and long contact time for ozone to be effective, has the disadvantage that O3, even in very small concentrations, is harmful to the animal and human organisms. The maximum allowable concentration of O3 in cattle-raising facilities is 0.1 ppm. The use of high vent stacks for the dilution of malodorous emissions is, though effective, rather expensive. Scrubbing of the vent air on a large water surface proved to be very effective in both odor and dust control. The efficiency of scrubbers for volatile fatty acids and NM3 was measured to be about 70% and 80-99%, respectively. Aeration of liquid and solid manure inside and outside cattle-raising facilities is an effective method for the prevention of anaerobic decay that is chiefly responsible for malodorous emissions.

34280 **APTIC NO. 56975**

Kanbe, Ryuzo and Yasumichi Aso

REMOVAL OF HCN IN EXHAUST GAS AFTER FUMIGATION. *(Kunjo haigasu-chu no shian-ka suiso jokyo). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 8(3):345, Oct. 1973. (Presented at the Japan Society for Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 89.)*

The best adsorption rate of hydrogen cyanide is obtained by a catalyst layer of manganese dioxide and oxidizing agent particles. When adsorption quantities of sulfur dioxide, hydrogen sulfide and HCN by soda lime, activated carbon, a mixture of catalyst and soda lime, and a catalyst are compared, the per gram adsorption quantity of the last item is much greater in all categories than any other adsorbent. For the treatment of arsenic gas fumigation of fruit and vegetables in storage, the effective use of a filter layer is important. The environmental standard of HCN depends on localities, but generally it is less than 10 ppm. For the treatment of a 1000 ppm-concentration exhaust gas, if one filtering is used, the adsorption rate must be more than 99%. Economical designing of the treatment of high concentration gas should include an effective use of filter layers by circulated ventilation.

34281 **APTIC NO. 57201**

Kim, Yong K., Melvin E. Deming, and John D. Hatfield

DISSOLUTION OF LIMESTONE IN SIMULATED SLURRIES FOR THE REMOVAL OF SULFUR DIOXIDE FROM STACK GASES. *Am. Chem. Soc., Div. Environ. Chem., Prepr., 13(2):33-37, Aug. 1973. 4 refs. (Presented at the American Chemical Society, National Meeting, 166th, Chicago, Ill., Aug. 26-31, 1973.)*

The effects on limestone dissolution rate of the pH of the slurry, the temperature, the oxygen content of the carrier gas, the particle size of the stone, and the addition of benzoic acid were studied. The dissolution rate equals 1.92 + 325/particle diameter of stone times (6.15 pH) times (1.4 - 0.08 times the oxygen content % of gas) to the (-1450/(gas constant times temperature)) power. When the limestone slurry was used for the absorption of sulfur dioxide at about pH 5.5, both the dissolution rate and the degree of utilization of limestone were nearly proportional to the geometric surface of the stone. Addition of benzoic acid increased moderately both the dissolution rate and the utilization of the stone. Raising the pH of the slurry decreased the dissolution rate markedly, but decreased only slightly the utilization of the stone. Increasing the O_2 concentration decreased both the dissolution rate and the utilization of the stone. Raising the temperature increased both the dissolution of the stone. Finer grinding significantly increased the utilization of the stone. It is estimated that the average diameter of the particle should be 30 micron or less to obtain 90% or more utilization of the stone under normal operating conditions of the limestone scrubbing process. Prolonged recycling of the slurry increased the stone utilization very slightly. (Author conclusions modified)

34282 **APTIC NO. 57333**

Knapp, Heinrich

FUEL INJECTION AND ITS CONTRIBUTION TO EXHAUST EMISSION CONTROL. *SAE-Australasia, 33(5):210-214, Sept.-Oct. 1973. 5 refs. (Presented at the Society of Automotive Engineers of Australia, National Convention, 73rd, Nov. 2, 1973, Paper 25.)*

Fuel injection is discussed as an exhaust emission control process. The positive effects of fuel injection on exhaust emissions include: equal distribution of fuel-air mixture to the individual cylinders, more precise calibration in the complete engine operating range, and more precise warm-up enrichment control. A decrease in carbon monoxide emission is caused mainly by the leaner calibration which is made possible by electronic fuel injection. The engine operating range which is covered by the emission test schedule, the engine is run with excess air which leads to lower CO emissions. The hydrocarbon emissions follow the trend of CO emissions, while the nitrogen oxides emissions depend on the peak combustion temperature. Specific systems which are discussed include: The D-Jetronic system, an electronically controlled system; the K-Jetronic, a continuous mechanical fuel injection, and an emission control system using a one-bed catalyst and feedback control from the alpha-sensor.

34283 **APTIC NO. 57245**

Kobylinski, Thaddeus P. and Brian W. Taylor

REDUCTION OF NITRIC OXIDE WITH CARBON MONOXIDE AND HYDROGEN OVER SUPPORTED NOBEL METAL CATALYSTS. *Am. Chem. Soc., Div. Petrol. Chem., Preprints, 18(3):431-440, Aug. 1973. 7 refs. (Presented at the Symposium on Catalytic Approaches to Environmental Control, Chicago, Ill., Aug. 26-31, 1973.)*

The catalytic reduction of nitric oxide, one of the noxious components of automobile exhaust gases, with carbon monoxide and hydrogen over supported nobel metal catalysts was studied. The relative importance of various reactions in the competitive CO/H_2 reaction system, and the effectiveness of catalysts for ammonia decomposition, and especially the effect of CO on this reaction, were investigated. During the reduction of NO with H_2 with the temperature of 50% NO conversion as an activity indicator, the relative activity sequence of the nobel metal catalysts was palladium greater than platinum greater than rhodium greater than ruthenium. For the reduction of NO with CO, the activity sequence was Ru greater than Rh greater than Pd greater than Pt. An equimolar CO/H_2 mixture behaves in a similar manner to CO alone. The reaction mechanism of this system is described. In the reduction of NO with H_2 or CO/H_2 mixtures, the selectivity towards NH_3 formation is lower over Rh and Ru catalysts than over other nobel metal catalysts, and Rh and Ru catalysts are among the most active for decomposition of ammonia. A study undertaken to determine whether these properties are directly related to each other showed that NH_3 decomposition is not responsible for the fact that those catalysts which are most active for decomposition form the least NH_3 in reduction of NO. The reaction mechanism for this is described.

34284 **APTIC NO. 56967**

Larson, Dennis M.

CONTROL OF ORGANIC SOLVENT EMISSIONS BY ACTIVATED CARBON. *Metal Finishing, 71(12):62-65, 70, Dec. 1973. 4 refs.*

Activated carbon adsorption of organic solvent emissions can be more than 90% efficient. Such systems are preferred by most control agencies. The adsorptive power of activated carbon, the historical development of such systems, and present use of the systems are discussed. Activated carbon adsorption is frequently used in the metal finishing industry for vapor degreasing. Activated carbon adsorption systems operating where stabilized, chlorinated solvents are used for vapor degreasing do not substantially reduce the stabilizer level in the solvent, with the exception of the recovery of 1,1,1-trichloroethane. Activated carbon systems are also used for paint spray booth and bake oven applications in the metal finishing industry. Control costs are cited.

34285 **APTIC NO. 57286**

Lewis, P. S., F. G. Shultz, and W. E. Wallace, Jr.

SULFUR REMOVAL FROM HOT PRODUCER GAS. *Am. Chem. Soc., Div. Fuel Chem., Preprints, 18(4):5-10, 1973. 4 refs. (Presented at the American Chemical Society, National Meeting, 166th, Chicago, Ill., Aug. 26-31, 1973.)*

The gasification of coal to produce low-BTU fuel gas for power generation was studied in a stirred fixed-bed. Thirty-two materials were tested as solid sorbents for the hydrogen sulfide in the hot producer gas. A mixture of iron oxide and fly ash was the best sorbent. The sintered iron oxide sorbent was made in pilot quantities and tested in two sorption-regeneration cycles cleaning gas generated by the stirred-bed producer using Upper Freeport coal. Hydrogen sulfide concentration averaged 380 grains/100 scf, and the gas contained approximately 1/2 lbs of dust, 1 lb of tar, and 5 lbs of steam per 1000 scf. Hydrogen sulfide leaving the sorbent bed had a reduced concentration of 10-20 grains/100 scf; removal efficiency was 95-97%. Tar was not removed. In a test with Western Kentucky No. 9 coal, H_2S concentrations of 588, 518, and 478 grains/100 cu ft at bed temperatures of 1100, 1200, and 1300 F, respectively, were decreased to 100 grains/100 scf. The reaction mechanism is chemisorption. The sintered sorbent is effective at up to 1500 F and has long life when used in a fixed bed.

34286 **APTIC NO. 57756**

Lind, J., T. E. Eriksen, and T. Westermark

ON THE REMOVAL OF ODOROUS KRAFT MILL GASEOUS EMISSIONS BY IONIZING RADIATION. *Svensk. Papperstid. (Stockholm), vol. 15:571, 1973. 5 refs.*

The removal of odorous kraft mill gaseous emissions by ionizing radiation is discussed. Divalent sulfur compounds, hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide, present in the gaseous emissions are depleted by ionizing radiation. A study of gamma irradiation of nitrogen-1% oxygen mixtures containing 0.09 mol cu m of methyl mercaptan show that around 9 moles of mercaptan/kWh are depleted. The total cost of radiation energy delivered by an electron accelerator is between 0.20-0.25 $/kWh. With a nominal value of 20 moles/ton of pulp of emissions containing gaseous S compounds the total cost for the elimination of these pollutants will be 0.45-0.55 $/ton of pulp.

34287 **APTIC NO. 57241**

Lloyd, William G. and Donald R. Rowe

THE LOW TEMPERATURE CATALYTIC OXIDATION OF CARBON MONOXIDE. *Am. Chem. Soc., Div. Petrol. Chem., Preprints, 18(4):482-486, Aug. 1973. 14 refs. (Presented at the Symposium on Catalytic Approaches to Environmental Control, Chicago, Ill., Aug. 26-31, 1973.)*

The oxidation of carbon monoxide to carbon dioxide by aqueous palladium (II)copper(II) was studied. The results of homogeneous systems showed that at an intermediate anion ratio (chloride:nitrate equal 1:4), a sharp conversion maximum was attained. Another series of runs indicated that bromide ion can substitute for chloride ion, nitrate ion can be replaced by sulfate ion, and the entire co-catalyst salt can be replaced by the organic oxidant benzoquinone, at the price of going to a substantially nonaqueous system. An initial series of heterogeneous system runs at 22 C, with supported catalysts containing 40-90% sulfate and a mixture of dry air and CO-helium, showed no significant conversions. A second series carried out with a low-moisture gas mixture showed most catalysts effected initial conversions of CO to CO2 in the range of 60-90%, and most catalysts showed well-defined decays in conversion efficiency with time. Heterogeneous (supported) Pd(II)/Cu(II) catalysts with the appropriate anion balance were highly effective for conversion of CO at ambient and superambient temperatures. Catalyst efficacy was sensitive to anion balance. None of the catalysts worked with completely dry streams; only one worked really well with low moisture; several worked well wight gas mixtures of higher moisture content. The use of a nonvolatile polyether was an advantageous modification for low-moisture gas streams. The mechanisms for these reactions are described.

34288 **APTIC NO. 57123**

Mori, Kenji, Kei Utsunomiya, Kazuya Soga, Katsunori Shimazaki, Mamoru Aoki, and Utaka Mito

CATALYTIC REDUCTION OF NITRIC OXIDE ON SEVERAL METALS. *(Kinzoku shokubai ni yoru sanka chisso no kangen). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):347, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 91.)*

For the purpose of developing nitric oxide reduction catalysts for internal combustion engines, various low metal catalysts with small ammonia production were made and the catalytic reduction rates were checked. The tests were given for NO-carbon monoxide, NO-CO-oxygen, and NO-hydrogen, and reaction temperatures and NO reduction rate (amount of NH3) were measured. Alloys with monel base were made with nickel-copper-chromium, nickel-copper-cobalt, and nickel-copper-iron. These alloy chips were oxidized in the air for 5 min at 800 C, and 5 min at 1000 C before use as catalysts. In addition, monel alloy, inconel alloy, perovskite, platinum, and platinum-gamma alumina catalysts were used for comparison. With the NO-CO tests, generally all monel alloys improved NO reduction with the less amount of added Co and Cr. Generally, oxidized alloys showed much lower activity temperatures than untreated alloy catalysts. In the NO-H2 test, the alloy catalysts produced less ammonia than Pt/gamma-alumina, but the quantity was still quite considerable.

34289 **APTIC NO. 57717**

Naber, J. E., J. A. Wesselingh, and W. Groenendaal

NEW SHELL PROCESS TREATS CLAUS OFF-GAS. *Chem. Eng. Progr., 69(12):29-34, Dec. 1973. 6 refs.*

The Shell Claus Off-gas Treating (SCOT) process can remove residual sulfur compounds present in the off-gas of Claus-type sulfur recovery units. The process consists of a reduction stage in which all sulfur compounds and elemental sulfur in the off-gas are reduced to hydrogen sulfide and an absorption stage in which H2S is removed after water removal by condensation by amine absorption/regeneration and is recycled to the Claus unit. With the SCOT process, the total sulfur recovery can be increased to above 99.8% on sulfur intake to the Claus unit. The unit is flexible -- an operating range of 20-100% on intake can be easily obtained, and changes in the SCOT feed gas composition have only a small effect on the overall recovery. Bench-scale studies and all development studies on the reduction step of the SCOT process were performed with a cobalt/molybdenum-on-alumina catalyst. A life test of more than 4000 hr showed the reduction catalyst to have completely stable activity, with residual sulfur dioxide content below 10 ppm. The presence of C1-C4 hydrocarbons did not hamper the performance of the reduction catalyst. Total costs of the add-on SCOT unit are $720/stream day, $1230, and $3560 for capacities of the Claus unit of 100 tons of sulfur intake/stream day, 200 tons/day, and 1000 tons/day, respectively. Costs for the SCOT integrated unit are $640, $1030, and $3160, respectively.

34290 **APTIC NO. 57758**

O Brien, J. B.

THE EXHAUST EMISSIONS OF AUSTRALIAN VEHICLES AND THE EFFECT OF A DEPOSIT CONTROL ADDITIVE. *SAE-Australasia, 34(4):154-160, July/Aug. 1973. 8 refs.*

The exhaust emissions of Australian vehicles and the effect of a fuel additive which controlled deposits in the carburetor and crankcase were surveyed and compared to data from other populations. The average carbon monoxide value was 4.89 vol% for 1127 cars and comparable to that of similar surveys in Europe and the United States. The average hydrocarbon level of 451 ppm mole hexane equivalent for 756 cars is also comparable to other surveys. In the deposit control test, after approximately 3000 mi of home-to-work and family driving, the cars emitted an average of 15.6% less CO at idle than at the start of the test. The control fleet maintained nearly the same average CO after the 3000 mi test period. Average idle exhaust emissions decreased 37.9% for the test fleet, whereas the control fleet showed a decrease of only 2.6%. The average idle rpm of the test fleet increased by 9.6% over the 3000 mi, while the control fleet increased 0.7%.

34291 **APTIC NO. 57344**

Petukhov, A. G. and A. I. Konovalov

EXPERIENCES GAINED IN THE KILN THERMOMETER FACTORY IN THE AIR POLLUTION CONTROL AREA. *(Opyt raboty Klinskogo termometrovogo zavoda po ozdorovleniyu atmosfernogo vozdukha). Text in Russian. Gigiena i Sanit., no. 10:98-99, 1973.*

Measures taken to abate mercury vapor emissions at the Kiln thermometer factory are described. As the use of vent stacks with increased height and the extension of the sanitary protection zone around the factory to 1000 m would not have been satisfactory, all vent air from shops handling Hg in any form were subjected to filtration through granulated manganese ore as adsorbent. It has been possible to lower the ground-level Hg concentrations below the maximum allowable levels. The one-time Hg concentrations measured at 100, 250, 1000, 2000, and 3000 m distance of the shops were 0.0023, 0.0011, 0.00048, 0.00045, and 0.0003 mg/cu m. The daily averages, determined at 250 and 500 m distance of the 62 m-high vent stack were 0.0005 mg/cu m and 0.00012 mg/cu m, respectively.

34292 **APTIC NO. 57720**

Reed, T. B. and R. M. Lerner

METHANOL: A VERSATILE FUEL FOR IMMEDIATE USE. *Science, 182(4119):1299-1304, Dec. 28, 1973. 35 refs.*

The properties of methanol are discussed. Although methanol (CH3OH) is not the cheapest fuel ($0.183/gal), its properties make it competitive with other fuels. The energy content (heat of combustion) of methanol is 20.1 kjoule/g (15.9 kjoule/cu cm). Existing internal combustion engines can be converted to methanol use by decreasing the ratio of air to fuel from 14 for gasoline to 6 for methanol, by recycling more heat from the exhaust to the carburetor, and by providing for cold starts. The conversion is estimated to cost about $100/vehicle. Methanol fuel in a standard test engine yields 1/20th of the unburned fuel that gasoline yields, 1/10th the carbon dioxide, and about the same amount of nitrogen oxides. A methanol car almost met the 1976 Federal emission standards and had five times less emissions than a gasoline car. The principal drawback to the immediate use of pure methanol as a gasoline substitute is that not enough is available. When 5-30% methanol was added to gasoline, fuel economy increased by 5-13%, carbon monoxide emissions decreased by 14-72%, exhaust temperatures decreased by 1-9%, and acceleration increased up to 7%. Methanol could also be used for home heating and electricity generation. A mixture of methanol and other alcohols called methyl-fuel was tested against fuel oil and natural gas in a power plant boiler. The methyl fuel produced no particulates, less NOx than natural gas and much less than oil, less CO, no sulfur compounds, and negligible aldehydes, acids, and unburned hydrocarbons, and burned off soot deposits from previous oil-firing. Methanol is one of the few known fuels suited to power generation by fuel cells. Methanol can be manufactured from gas, coal, or wood. Coal can be gasified to obtain synthesis gas (CO plus hydrogen) which can then be converted into methanol. The cost of making methanol from coal would be $1.40/10 to the 6th power kjoule ($0.085/gal) for a plant making 20,000 metric tons/day. Solid refuse can possibly be converted to methanol.

34293 **APTIC NO. 57531**

Reisenweber, Richard Lewis

A COST EFFECTIVENESS COMPARISON OF POINT SOURCE CONTROLS AND EMISSION DENSITY ZONING AS STRATEGIES FOR ACHIEVING REGIONAL AIR QUALITY. *Washington Univ., St. Louis, Mo., Dept. of Sanitary and Municipal Engineering, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1973, 227p. 62 refs.*

A model was developed to compare and evaluate two emission control strategies: emission density limited zoning (EDIZ) and point source controls (PSC). These strategies were analyzed on a cost-effectiveness basis by comparing their total annualized costs. The model showed that both strategies achieve ambient air quality with the resulting average pollutant concentration throughout the region being less for EDIZ which is more costly, assuming a stable zoning process. Model testing used 475 selected process and fuel combustion sources from a six-county region in the Chicago metropolitan area. The data contained input of land-use and point-source data by land-use class, economic activity in the Standard Industrial Classification code, energy consumption, and an emission file. (Author abstract modified)

34294 **APTIC NO. 57336**

Rushton, J. D.

HANDLING SULFUR COMPOUNDS FROM PULP MILLS. *Chem. Eng. Progr., 69(12):39-46, Dec. 1973. 3 refs.*

The design of odor control systems for kraft pulp mills are reviewed. There are three separate systems, the design of which involves collection and then disposal of the odorous gases by incineration. The type of collection and incineration systems is vastly different for each component. In the low-volume, high-concentration system, the major design problem that must be overcome is the collection of the digester blow gases. The blow heat recovery system must be adequately sized to condense all the flash stream from the blow and reduce the volume of odor-containing gases to be collected. In a high-volume, low-concentration system the odorous gases are are combined and routed to the suction side of the recovery boiler secondary air fan and combined with any additional secondary combustion air which might be require by the boiler. Odors from the contaminated condensate and water stripping system must also be controlled. Most mills now use surface condensers on the their evaporators. Thus, by collecting these condensates and the water from the evaporator hotwell, the evaporator odor not collected in the odorous gas system can be contained. These streams are sent to the stripper feed tank.

34295 **APTIC NO. 57340**

SAFETY SYSTEMS AND AIR POLLUTION. PART 13: CONCLUSION. 9. TORCH COMBINATIONS. *(Veiligheidssystemen en luchtverontreiniging 13/slot. 9. Fakkelcombinatiesystemen). Text in Dutch. Polytech. Tijdschr., Ed. Procestechniek (The Hague), 28(5-9):594-601, 1973. 30 refs.*

Various combinations of flare systems for the release and combustion of emissions in the petroleum and chemical industries are described. Integrated flare stacks incorporate the flare tip, a molecular seal, and the waterseal drum in the same stack. Multi-jet ground flares, to be installed at a minimum height of 2 m above the ground, are used for the continuous combustion of small emission volumes without smoke and soot by means of injected steam. Waste gas discharge peaks are handled by a separate high torch connected with a separate waterseal drum. Thermal oxidizer flares, composed of conventional burners at the top of the high torch, are suitable for the safe incineration of a great variety of waste gases. Thermal oxidizers, equipped with high stacks, use fuel oil or natural gas for the incineration of harmful and toxic waste gases.

34296 **APTIC NO. 57343**

Schwartz, Reinhard, Gerhard Stumpp, and Heinrich Knapp

K-JETRONIC - CONTINUOUS GASOLINE INJECTION BY BOSCH. *(K-Jetronic - kontinuierliche Benzineinspritzung von Bosch). Text in German. Automobiltech. Z., 75(12):453-459, 1973.*

Design and operation of the K-Jetronic fuel injection system by Bosch is described along with some exhaust emission measurement data obtained for engines equipped with such fuel injection systems. The mixture corrector of the K-Jetronic is built in, horizontally suspended, before the throttle valve in air flow direction. The specific carbon monoxide, hydrocarbon and nitrogen oxide emissions from engines equipped with K-Jetronic fuel injection systems were in the respective ranges of 11.2-22.7 g/mi; 1.13-2.18 g/mi, and 1.76-4.0 g/mi, against the 1973 limit values of 39 g/mi for CO, 3.4 g/mi for HC, and 3.0 g/mi for NOx.

34297 **APTIC NO. 57311**

Sitkei, Gyorgy

POSSIBILITIES FOR REDUCING THE AIR POLLUTION CAUSED BY INTERNAL COMBUSTION ENGINES. *(A belsoegesu motorok okozta levegoszennyezes csokkentesenek lehetosegei). Text in Hungarian. Musz. Tud., 46(3-4):343-347, 1973.*

Technical and economic measures for the abatement of motor vehicle-generated air pollution are described. Carbon monoxide emissions from spark-ignition engines are lowest at air excess coefficients of or slightly greater than 1. The lowest unburned hydrocarbon concentration is obtained for air excess coefficients slightly greater than 1. Though both the CO and HC emissions are lowest at air excess coefficients comprised between 1.0 and 1.1, this range of the air excess coefficients is responsible for the highest nitrogen oxide emissions. The HC and NOx emissions can also be controlled by proper ignition timing and by the use of gasolines with adequate octane ratings, respectively. Soot emissions from diesel engines can be effectively controlled by proper adjustment of the injection time. Prechamber diesels are especially suitable for use in vehicles intended for city traffic due to their substantially reduced NOx emissions compared with direct injection engines. The elaboration of specific emission standards for motor vehicle emissions in g of pollutant per km, the completion of regular vehicle inspections with exhaust emission tests, and the ban of two-stroke engine-powered vehicles, are further measures to be taken to abate motor vehicle-generated air pollution.

34298 **APTIC NO. 57507**

Swift, William Morton

DESULFURIZATION OF CALCIUM SULFATE IN A MULTIPLE ZONE REACTION. *Iowa State Univ., Ames, Iowa, Dept. of Chemical Engineering, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1973, 230p. 58 refs.*

Desulfurization of calcium sulfate in a multiple-zone reactor was investigated. Formation of calcium sulfide was very rapid and was controlled by equilibrium considerations. Larger particles of CaSO4 exhibited less sulfide for ation than smaller particles during reductive decomposition due to an increased resistance to mass transport by diffusion in the larger particles. Elimination of CaS formation during the reductive decomposition process was found attainable by oxidation in a fluidized bed to give a mixture of calcium oxide and CaSO4. Calcium oxide formation was favored in the oxidation process by an oxygen to CaS mole ratio of 1.5:1 and was also favored at temperatures of 2100 F or above. Decomposition of coarse CaSO4 was readily accomplished in a multiple-zone reactor consisting of reducing and oxidizing zones, and the amount of CaS formed was generally less than 0.5%. Conversion and desulfurization of the CaSO4 appeared to be limited only by the residence time of the solids in the reactor, and the required residence time for high conversions appeared to be a strong function of temperature, indicating a reaction-controlling mechanism for the overall process of reduction and oxidation. The multiple zone reactor also contributed to low sulfide levels in the fines elutriated from the reactor. The decomposition of CaSO4 is important to the process of removing sulfur oxides from combustion products by adding limestone to the fluidized bed to adsorb the liberated sulfur dioxide.

34299 **APTIC NO. 57723**

Tanaka, Nobutoshi, Kazutaka Makino, and Koichi Iinoya

ON THE ECONOMICALLY OPTIMAL DESIGN OF AIR FILTER. *(En firuta no keizai saiteki sekkei ni tsuite). Text in Japanese. Kagaku Kogaku (Chem. Eng.), 37(12):72-80, Dec. 1973. 7 refs.*

The annual cost of an air filter is formulated in terms of the fixed and power costs of a fan, the fixed cost of an air filter, and the renewal cost of a filter medium. For an automatic renewal-type air filter, in particular, the cost of a medium is estimated considering the merit of a partial renewal operation. For several typical media, the optimal filtering velocity and the operating pressure drop (the final value in a panel-type and average value in an automatic renewal-type) are then calculated for various values of flow rates and dust concentrations. Approximate optimal solutions are analytically derived and the sensitivity of various parameters on the optimal solutions is discussed. The optimal conditions are remarkably affected by dust concentration, or the pressure drop characteristics of a medium, but hardly at all by flow rate. In an automatic renewal type, it is shown that 20% cost reduction, at most, is obtained by a partial renewal operation. (Author abstract)

34300 **APTIC NO. 57131**

Tanaka, Yutaka, Masaki Abe, Noboru Yoshino, Minoru Okamura, and Ken Nakamura

EFFECTS ON THE MEASURES USING TWO METHODS, THE DELAY OF THE SPARK TIMING WITH CATLYTIC CONVERTER AND THE CONTROLLING DEVICES OF THE SPARK TIMING WITH CATALYTIC CONVERTER. *(Tenja jiki chosei oyobi tenka jiki seigyo sochi to shokubai sochi o heiyo shita baai no haishutsu gasu gensho koka ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):335, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 80.)*

The effects of spark timing delay, a spark timing control device, and a catalytic converter, separately and in combination, on automotive exhaust emission gases were examined by chassis dynamometer, flame ionization, non-dispersion infrared analysis, and chemiluminescence. The reduction effect by different modes and speeds, the effects on car performance, and the temperature rise in the catalytic converter were checked. Both combinations, spark time delay and catalytic converter, and spark time control device and catalytic converter, had marked reduction effects on the amount of both carbon monoxide and hydrocarbons. The use of spark timing delay or control device alone had no effect on CO and HC emissions, but reduced the amount nitrogen oxides to a certain extent. The use of these devices increased fuel consumption approximately 20% and reduced acceleration about 10%. In a room test, the total load-3000 rotation condition caused a considerable temperature rise in the catalytic converter. However, in an actual driving test out of doors, the temperature did not exceed 60 C.

34301 **APTIC NO. 57244**

Unland, Mark L.

ISOCYANATE INTERMEDIATES IN THE REACTION NO + CO OVER A PT/AL2O3 CATALYST. *Am. Chem. Soc., Div. Petrol. Chem., Preprints, 18(3):453-460, Aug. 1973. 25 refs. (Presented at the Symposium on Catalytic Approaches to Environmental Control, Chicago, Ill., Aug. 26-31, 1973.)*

Since the reduction of nitrogen oxides with carbon monoxide also present in auto exhaust could present an efficient means of removal, the mechanism of nitric oxide plus CO reaction over a typical auto exhaust catalyst, platinum/alumina, was studied by intensive use of infrared spectrophotometry. Physical and chemical adsorption of the reactants, products, and intermediates on the catalyst surface were examined. To establish reference points for this particular sample, the individual spectra of the reactants and possible products of the NO + CO reaction were obtained. To gain more information about the nature of the bands observed, temperature experiments were carried out on the Pt/Al203 sample using a 10% CO, 5% NO, and 85% nitrogen gas blend. The room temperature spectrum was quite different from spectrum obtained at elevated temperatures; the only common feature was the CO band at 2090/cm. From the temperature dependence of the bands at 2267 and 2148/cm and since they were not due to adsorbed reactants or products, it appears likely that they arose from intermediates in the reduction of NO with CO over the Pt/Al203 catalyst. Another experiment with 10% CO and 15%, 10%, and 5% NO in nitrogen showed that the species giving rise to the bands at 2267/cm and 2148/cm required excess CO before they were formed. If NO is in excess, it will either react with these species or otherwise prevent their formation in appreciable concentrations. During carbon(13) and nitrogen(15) labeling experiments, isotope shifts for the Pt/Al203 sample were determined. The most intense band was assigned as an isocyanate species. The importance of such a surface species should not be overlooked, since it could be involved in the formation of ammonia in automobile catalytic converters. The importance of an isocyanate intermediate route to NH3 cannot now be assessed since the experimental conditions used were far removed from reality.

34302 **APTIC NO. 57332**

Watkins, C. H., A. G. Lickus, and H. J. Niclaes

HYDRODESULFURIZATION OF REDUCED CRUDES BY RCD UNIBON. *Ingenieursblad, 42(22):651-658, Jan. 1973. 2 refs.*

The hydrodesulfurization of reduced crude sulfur fuel oil by the RCD Unibon process is reviewed. Metal deposition is the controlling deactivation mechanism for deep desulfurization of reduced crudes. Residual oils of low to moderate metal contents (nickel and vanadium contents less than 100 ppm) and sulfur contents as high as 5 wt% can be directly desulfurized to yield heavy fuel oil products containing as little as 0.3 wt% S. The most important Middle East reduced crudes are classified as RCD Unibon feedstocks based on their metallic and asphaltene contents. There are commercial processes for all types but those with a metal content greater than 200 ppm Ni and V. Pilot plant studies indicate that the hydrosulfurization reaction rates for these materials are similar to those crudes containing 65-110 ppm Ni and V.

34303 **APTIC NO. 57677**

Wen, C. Y. and S. Uchida

ABSORPTION OF SO_2 BY ALKALINE SOLUTIONS IN VENTURI SCRUBBER SYSTEMS (FINAL REPORT). *West Virginia Univ., Morgantown, W. Va., Dept. of Chemical Engineering, U. S. Environmental Protection Agency Contract EHS-D-71-20, Grant 800781, Program Element 1A2013, EPA-650/2-73-003, 171p., July 1973. 130 refs.*

NTIS: PB-224202/AS

The absorption of sulfur dioxide from flue gases by water and alkaline solutions in venturi scrubber processes is discussed. Mathematical models are proposed describing the process momentum, heat, and mass transfer for SO_2-water, SO_2-sodium hydroxide-H_2O, SO_2-calcium oxide-H_2O, and SO_2-calcium carbonate-H_2O systems. The monentum, heat, and mass balances describe the performance of the processes taking place in the venturi scrubber. A set of first order, nonlinear, ordinary differential equations were calculated relating total pressure, liquid velocity, and SO_2 concentration in the liquid along with the axial direction. These equations are solved numerically for performance profiles, which are used to examine the effects of such operating variables as liquid flow rate and the concentration of alkali in the liquid phase on the absorption rate. Data are analyzed from variously sized holding tanks and mathematical models are proposed for the lime/limestone slurry process holding tanks. The venturi/holding-tank system is simulated with closed-loop recycling of the liquor. The sensitivities of such operating variables as the recycling liquor rate and the alkali makeup rate on the absorption are examined. (Author abstract modified)

34304 **APTIC NO. 57646**

National Academy of Sciences, National Research Council, Washington, D. C., Committee on Motor Vehicle Emissions

REPORT BY THE COMMITTEE ON MOTOR VEHICLE EMISSIONS. *Environmental Protection Agency Contract 68-01-0402, 154p., Feb. 12, 1973.*

The technological feasibility of meeting the motor vehicle emissions standards prescribed in the Clean Air Amendments of 1970 was investigated. For the 1975 model year light-duty motor vehicles, four types of systems will meet the prescribed emissions standards during certification testing. These are the modified conventional engine equipped with an oxidation catalyst, the carbureted stratified charge engine, the Wankel engine equipped with an exhaust thermal reactor, and the diesel engine. For the 1976 model year light-duty motor vehicles, five control systems now in early stages of development have met the 1976 emission standards at low mileage. These are the modified conventional engine equipped with dual catalysts, or with dual catalysts plus thermal reactor, or with two thermal reactors and a reduction catalyst, or with a three-way catalyst and electronic fuel injection and equipped with an oxidation catalyst. The recently developed carbureted stratified charge engine, after 50,000 mi of durability testing on a compact car, has achieved well over the 90% reduction in hydrocarbon and carbon monoxide emissions called for in the Act and about 83% reduction in nitrogen oxides. If certifiable, vehicles incorporating any of these systems can be mass produced, but not necessarily in great enough volume to satisfy the expected demand for vehicles in model year 1976. (Author summary modified)

34305 **APTIC NO. 57673**

Singmaster and Breyer, New York

AIR POLLUTION CONTROL IN THE PRIMARY ALUMINUM INDUSTRY: VOLUME I, SECTIONS 1 THROUGH 10. *Environmental Protection Agency Contract CPA 10-21, EPA-450/3-73-004a, 378p., July 23, 1973. 56 refs.*

NTIS: PB-224282/AS

The technical and economic aspects of the emissions and control of air pollutants in the primary aluminum industry were investigated. The cost and performance data base include detailed information by the domestic producers, typical performance data obtained from equipment suppliers, and published information from the technical literature. Engineering analysis of the data by the contractor resulted in a systems evaluation of current industry control in terms of present costs and performance. Systems analysis was applied to growth projections at various control levels to estimate future costs and emissions. Recommendations were made covering the direction of research and development efforts towards improvement in pollution abatement by the industry.

1972

34306 **APTIC NO. 57271**

Alliger, Howard

A NEW AIR POLLUTION ABATEMENT DEVICE. *Preprint, American Chemical Society, 7p., 1972. (Presented at the American Chemical Society, National, Meeting, 163rd, Boston, Mass., Aug. 1972.)*

A new type of air pollution abatement device called the MYSTAIRE Scrubber was developed which is capable of removing particles well down in the 0.01 micron range as well as odors, bacteria, fumes, and gaseous contaminants such as sulfur dioxide and oxides of nitrogen. A WATERWEB mesh, consisting of some 500 layers of wetted screen stapled together at various points, is the heart of the scrubber system and appears to have an almost catalytic-like effect in wetting particles flowing in the air. Air and water go in the same direction, unlike most other packed bed type scrubbers; flow is not countercurrent. Wetting action is diffusional rather than by impaction or turbulence and is responsible for the fact that efficiency does not depend on pressure drop. An increase in the mesh area for a given air flow decreases the pressure drop and most likely increases the removal efficiency. The mesh does not clog when removing submicron particles.

34307 **APTIC NO. 57352**

Fluegge, Guenther

THE METHANE CONTENT IN MINE AIR DURING FAN BREAKDOWN. *(Der Methangehalt im Abwetterstrom von Streben bei Luefterstillstand). Text in German. Glueckauf (Essen), 108(7):242-245, 1972. 2 refs.*

Actual measurements and a mathematical method of the calculation of the methane content in direction-stable mine air flow during breakdown and start-up periods of main and auxiliary exhaust fans are described. Decrease in the methane content for at least the first 10 min after the stoppage of the fan is due to the increase of the barometric pressure, and rapid increase occurs in the methane content afterwards until an end value is reached. A decrease in the methane content from 0.8 to 0.6% in the initial period, and an increase to 2.5% in 3 hr were measured. The latter value was stable during the residual 5.5 hr of the breakdown. The decrease of the methane content after restart of the exhaust fan was even more rapid than the increase following breakdown. The background level is usually restored 1 hr after restart. Both the increase and the decrease in the methane content following breakdown and restart of the exhaust fan can be well approximated by saturation curves. While the methane content determined graphically for the initial period of the breakdown is realistic, that obtained for the rest of the breakdown period is usually higher than that occurring in reality. In mines where the additional gas emission is too small to prompt use of exhaust, the methane content to the air during shutdown of fans may exceed the lower ignition limit, while the methane content in mines with sufficient gas exhaust fails to exceed 2%.

34308 APTIC NO. 57615

Hardison, L. C. and Carroll A. Greathouse

AIR POLLUTION CONTROL TECHNOLOGY AND COSTS IN NINE SELECTED AREAS. (FINAL REPORT). *Industrial Gas Cleaning Inst., Stamford, Conn., Environmental Protection Agency Contract 68-02-0301, APTD-1555, 616p., Sept. 30, 1972. 74 refs.*

NTIS: PB 222746

Information on air pollution control for 16 processes in nine industrial areas was collected and formalized. Rendering odors can be controlled by thermal incineration at reasonable cost if the gas flow from odor-containing sources is limited severely by proper use of condensers and enclosures around equipment. Fluidized bed catalytic cracking units in petroleum refineries may be equipped with electrostatic precipitators which are adequate for the control of particulate emissions in all cases considered. Asphalt batch plants are adequately treated by both wet scrubbers and fabric collectors, with economic factors likely to influence the choice of equipment. Basic oxygen furnace steelmaking processes can be equipped with scrubbers or precipitators, with the latter generally being more economically favorable. Coal cleaning processes are treated exclusively by scrubbers, which have no unusual problems or performance limitations. Brick and tile kilns normally produce no significant emissions, although incineration and/or wet scrubbing may be necessary to eliminate visible smoke and/or fluorine or sulfur oxides. Copper smelting emissions can be controlled by cleaning the gas stream used as feed to a sulfuric acid plant or by wet scrubbing the gases vented to the atmosphere. Bark boilers in kraft mills can be equipped with mechanical boilers and precipitators or scrubbers to remove carbonaceous ash and fine fly ash. Ferrochrome and ferrosilicon furnaces produce particulates which can be adequately handled only by fabric collectors; wet scrubbers of very high pressure drop are capable of satisfactory operation but are unlikely to be competitive. Conclusions relative to thermal incinerators, electrostatic precipitators, scrubbers, and fabric collectors were drawn by generalizing data from all of the areas studied. Appendices cover Rule 54 of the Air Pollution Control District of Los Angeles County, instructions for submitting cost data, specifications for abatement equipment, and a statistical basis for data presentation. (Author summary modified)

34309 APTIC NO. 57541

Holub, Josef

PRODUCTION OF SMOKELESS FUEL BY PELLETIZING. *(Vyroba bezdymeho paliva peletizaci). Text in Czech. Ustav pro Vyzkum a Vyuziti Paliv, Prague (Czechoslovakia), Sb. Prednasek 50 (Padesatemu) Vyroci Ustavu Vyzk. Vyuziti Paliv, 1972, p. 65-77. 13 refs. 57106 Kireyeva, I. S. and N. Ya. Yanysheva THE EFFICACY OF PREVENTIVE MEASURES AGAINST THE CARCINOGENIC HAZARDS IN PRODUCTION OF COAL BRIQUETTES. (Ob effektivnosti meropriyatiy po preduprezhdeniyu kantserogennoy opasnosti pri proizvodstve ugol nykh briketov). Gigiena i Sanit., 37(2):10-13, Feb. 1972. 5 refs. Translated from Russian, 8p.*

The efficiency of preventive measures against the carcinogenic hazards in production of coal briquettes is reviewed. The carcinogenic compounds include 3,4-benzypyrene, anthracene, phenanthrene, perylene, derivatives of 1,2-benzanthrazene, pyrene, and carbozol. The amount of 3,4-benzpyrene in both the pitch and the briquettes was 1-2 order of magnitude larger than the amount of other hydrocarbons. The thermal processing of briquettes was evaluated as an effective means of removing carcinogenic substances. Under the working conditions prevailing in a briquette production facility employing pitch binder, the method is not sufficient. It is necessary to trap and utilize or neutralize the gaseous products that are formed in the process of coking the briquettes. In converting a briquette production facility to petroleum binding materials it is advantageous to use thermal treatment of the briquettes for a total elimination of carcinogens and to obtain essentially smokeless fuel. (Author conclusions modified)

34310 APTIC NO. 57535

Novohradsky, Miroslav

CATALYSTS AND DUE EQUIPMENT DEVELOPED AT THE FUEL RESEARCH INSTITUTE BECHOVICE FOR THE USE OF REFORMING HYDROCARBONS. *(Katalyzatory a prislusna zarizeni pro stepeni uhlovodiku vyvinuta v ustavu pro vyzkum a vyuziti paliv). Text in Czech. Ustav pro Vyzkum a Vyuziti Paliv, Prague (Czechoslovakia), Sb. Prednasek 50 (Padestemu) Vyroci Ustavu Vyzk. Vyuziti Paliv, 1972, p. 138-151. 18 refs.*

Research and development work aimed at reforming natural gas and higher hydrocarbons with water vapor, air, and carbon dioxide was opened at the Fuel Research Institute Bechovice in 1948/49. In the first stage, equipment for continuous reforming of natural gas with water vapor in tubes was developed, as well as equipment for partial oxidation of natural gas with air. Both presented prototypes of operational equipment constructed later. Necessary catalysts were prepared; the nickel-magnesium oxide catalysts on a ceramic carrier were best. In the second stage, the work was aimed at the development of catalysts for reforming. This was based on physical and chemical studies. The most successful catalyst, Cherox 32-02, was manufactured on an operational scale, and was used for reforming natural gas with water vapor and air in most Czechoslovakian equipment. The other prosperous catalyst, Cherox 32-08, was suitable for reforming gasoline and natural gas in the equipment IBEG. The sulfur in the catalyst was convenient for the production of detoxified gas by simultaneous reforming and converting to carbon monoxide with water vapor.

34311 APTIC NO. 57718

Parker, Robert F. and James W. Walker

EXHAUST EMISSION CONTROL IN MEDIUM SWIRL RATE DIRECT INJECTION DIESEL ENGINES. *Preprint, Society of Automotive Engineers, New York, 6p., 1972. 14 refs. (Presented at the Society of Automotive Engineers, National Combined Farm, Construction and Industrial Machinery and Powerplant Meetings, Milwaukee, Wis., Sept. 11-14, 1972, Paper 720755.)*

Medium swirl, direct injection diesel engines in the 50-200 hp range – typical of those used in farm, construction, and industrial machinery -- were analyzed for emissions of nitrogen oxides, carbon monoxide, hydrocarbons, and smoke. On-highway and agricultural weighting factors for the 13-mode cycle were compared. Naturally aspirated, turbocharged, and turbocharged intercooled versions of the basic engine were compared, along with possible emission reductions by exhaust gas recirculation of a naturally aspirated engine and retarded injection timing on turbocharged engines. The increase in fuel cost for nitrogen dioxide reduction by retarded timimg is presented. A difference in cycle weighting factors between on and off highway equipment, when calculating brake specific emission levels, did not appear to be justified. Reported emission levels on a g/cycle weighted hp basis represented a valuable tool in comparing factors affecting engine emissions. Turbocharging and turbocharging intercooling were effective control techniques when used in conjunction with retarded injection timing. Direct injection and indirect injection engines had similar fuel consumption at NO2 emission levels projected as required for the late 1970s. Exhaust gas recirculation seemed impractical at present, but requires further study.

34312 **APTIC NO. 57534**

Prasek, Karel

INTENSIFICATION OF OUTPUTS OF PRESSURE GENERATORS. *(Intenzifikace vykonu tlakovych generatoru). Text in Czech. Ustav pro Vyzkum a Vyuziti Paliv, Prague (Czechoslovakia), Sb. Prednasek 50 (Padesatemu) Vyroci Ustavu Vyzk. Vyuziti Paliv, 1972, p. 78-90.*

From 1959 to 1968 intensive work was carried out to raise the outputs of pressure generators. Its aim was to gradually increase the original output of a Lurgi-type generator from four 500 cu Nm raw gas/hr to 9000-12,000 cu Nm raw gas/hr. Experience with high output performance was obtained on a gradually modified generator with a shaft diameter of 2.76 m in the high-pressure fuel gas works Cheza Zaluzi. After several new types of grates were tested, the principal work was transferred to the coal gasification plant at Uzin which was operated with a prototype generator with central ash removal. This plant was designed as a result of field work and fundamental research into cold models of pressure generators. The output of 12,000 cu Nm/hr gas corresponded with the specific output of 2000 cu Nm/hr gas/sq m of the shaft, achieved with the use of a graded three-slot grate with a surface fitted with involute ribs. The results were applied to the gas works Cheza and Uzin; at Vresova, a newly developed type of generator was operated. The intensification of the generator outputs manifested itself in a considerably higher production of town gas generated from brown coal; when the Vresova works are completed, the total production will reach 2.5 times 10 to the 9th power cu Nm town gas/hr.

34313 **APTIC NO. 57614**

Riordan, R. M.

VAPOR GENERATOR FEED PUMP FOR RANKINE CYCLE AUTOMOTIVE PROPULSION SYSTEM (CHANDLER EVANS). *Chandler Evans, Inc., West Hartford, Conn., Control Systems Div., Office of Air and Water Programs Contract 68-01-0430, APTD-1357, 210p., Dec. 1972.*

NTIS: PB 222849

The development of a positive displacement pump with a variable output for use within the cycle loop of a Rankine cycle automotive propulsion system was studied. The data indicate the superiority of a system with either a gear or vane type pump in combination with a variable speed drive. In that high flows are needed only during acceleration transients and at very high speed cruise conditions, a staged pump configuration was investigated; the favored method involves running a two-stage pump in series normally, to be switched to parallel operation on demand. In order to achieve performance at the expander low-speed, high flow and high-speed, low flow extremes, an accumulator may be used at the high flow condition and a bypass valve at low flow. (Author summary modified)

34314 **APTIC NO. 57262**

Smola, V. I., D. I. Isayev, V. D. Nagibin, Yu. K. Pobedonostsev, and V. A. Zinkovskiy

CLEANING OF CONVERTER GASES USED FOR SULFURIC ACID PRODUCTION. *(Ob ochistke konverternykh gazov, ispol zuyemykh dlya polucheniya sernoy kisloty). Text in Russian. Tsvetn. Metal., 45(3):6-8, 1972.*

An installation for converter gas cleaning and recovery of the converter gas sulfur dioxide content for contact sulfuric acid production at the Balkhash smelter is described. The converter gas, exhausted individually from the converters by an automatic control system, is passed consecutively through a water-cooled dust screen, dust settling chamber, cyclones, and a Cottrell-type dry electrostatic precipitator, for the removal of dust prior to sulfuric acid production. The efficiencies of the dust settling chamber, the cyclone, and the dry electrostatic precipitators are 25%, 30%, and 98%, respectively. The dust content in the converter gas is reduced from an initial value of 10 g/N cu m to 4.33 g/N cu m before the electrostatic precipitators. The separated dust is recycled within the smelting process. The installation permitted increases in the lead recovery rate by 25 30%, in the sulfuric acid production by 10%, and reduction in the pollution level by 50%.

34315 **APTIC NO. 57114**

Sugawara, Fumiko

ABSTRACT OF MONOGRAPHS CONCERNING PREVENTION OF INDOOR AIR POLLUTION (SUSPENDED PARTICULATES) IN ARCHITECTURE (2) (1936- 1955). *(Kenchikugaku ni okeru shitsunai kuki osei (fugy jin ai) boshi ni kan-suru bunken shoroku (2) (Showa 11 - 30 nen)). Kuki seijo (Clean Air- J. Japan Air Cleaning Assoc., Tokyo), 9(2):58-70, 1972. 121 refs. Translated from Japanese, 49p.*

Abstracts of 22 monographs related to prevention of indoor air pollution from publications of the Architectural Institute of Japan (Nihon Kenchiku Gakkai) dating from the years 1936-1955 are presented. The publications include collected papers, research reports, branch research, and journal articles. The monographs are primarily concerned with dust, although several deal with carbon dioxide concentration and bacteria count.

34316 **APTIC NO. 57537**

Vejvoda, Josef and Milan Cernoch

A CONTRIBUTION OF THE FUEL RESEARCH INSTITUTE TO THE SOLUTION TO THE PROBLEM OF SULPHUR OXIDE EMISSIONS FROM THERMAL POWER STATIONS. *(Prispevek uvp bechovice k reseni problemu exhalaci kyslicniku siry z tepelnych elektraren). Text in Czech. Ustav pro Vyzkum a Vyuziti Paliv, Prague (Czechoslovakia), Sb. Prednasek 50 (Padesatemu) Vyroci Ustavu Vyzk. Vyuziti Paliv, 1972, p. 171-193. 9 refs.*

The desulfurization of flue gases was studied at the Fuel Research Institute Bechovice from 1967 to 1971. The preparation of the alkalized alumina absorbent with an introduced metal for regeneration purposes which was successful with nickel or cobalt and the development of dry limestone technology are described. Orientation tests were performed on large-sized boilers in several power stations. The reaction between sulfur dioxide and carbonates of alkaline earth metals was studied in the laboratory under conditions characteristic for flue gases. The influence of the components of flue gas and of flue ashes on the degree of calcium conversion was determined. Measurements were executed on a small laboratory apparatus to determine the temperature influence and the residence time influence on the desulfurization of an artificial mixture of flue gases and the calcination of calcium carbonate. An experimental furnace was developed for studying the conditions for SO2 removal from the flue gases and for modeling the process of combustion and desulfurization. Flue gas desulfurization was studied on an oil-fired 40 tons/hr boiler; 40-50% desulfurization of flue gases occurred at 1.5-2.0 excess of limestone in comparison with stoichiometry. A survey of capital expenditure and operational costs for a 800 MW power station is given with regard to the purchase of lump limestone and its grinding or for the exposure of a limestone quarry, both on the expenses of the power station, and for a periodical operation in periods of atmospheric inversions.

34317 **APTIC NO. 57482**

Wilson, C. A.

AIR POLLUTION ABATEMENT OF KINLEITH MILL OF N. Z., FOREST PRODUCTS LIMITED. *Clean Air Society of Australia and New Zealand, Proc. Int. Clean Air Conf., Melbourne, Australia, 1972, p. 233-236. (May 15-18.)*

Emission problems and air pollution abatement measures are outlined for a kraft process pulp mill in New Zealand. The major particulate emissions from the mill come from recovery boilers, lime kilns, and power boilers. Particulate emissions of significance are sodium sulfate, sodium carbonate, and calcium oxide (lime). The major gaseous components of the kraft mill odor are hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide, the latter being formed through oxidation of methyl mercaptan. The kraft mill odors are emitted from the recovery boilers, the lime kilns, digester and evaporator devices, the tall oil plant, and the chlorine plant. Abatement of particulates has been accomplished by installation of electrostatic precipitators or venturi scrubbers on the recovery furnace and lime kiln stacks. An odor control program includes packed towers using solutions containing caustic soda scrubbers which have been installed on the vents in the tall oil, evaporator, and chlorine plants. Preliminary designs have been developed for systems to burn the odorous gases from the batch digesters and to oxidize the sulfide in the black liquor in order to prevent sulfur emissions from recovery furnace stacks.

34318 **APTIC NO. 57627**

Winkler, Max K.

VAPOR GENERATOR FEED PUMP FOR RANKINE CYCLE AUTOMOTIVE PROPULSION SYSTEM. (FINAL REPORT). *Lear Motors Corp., Reno, Nev., Office of Air and Water Programs Contract 68-01-0437, APTD-1358, 69p., Dec. 1972. 5 refs.*

NTIS: PB 222871

Preliminary design studies were conducted to define feed pumps that satisfy the performance requirements for Rankine Cycle automotive power systems. A radial piston, variable displacement feed pump design was selected to satisfy these requirements. The proposed feed pumps hermetically seal the working fluid from the atmosphere and lubricating oil by utilization of a diaphragm seal. Conventional, low cost materials can be used throughout the pump s construction. The pumps designed for use with organic working fluids (AEF-78 and Fluorinol 85) will be physically larger than those designed for the demineralized water fluid. Ductile iron was selected as the material of construction for the pump housing. The projected feed pump performance will contribute to high cycle efficiency; full displacement mechanical efficiencies from 85 to 90% are feasible. An externally driven centrifugal type boost pump is recommended for use with the proposed feed pumps to assure reliable operation at all system operating conditions. The proposed feed pump does not meet the system contractor s mechanical efficiency requirements with respect to the low flow/high speed region of the estimated pump performance. Several elastimers were acceptable for operation with the two organic fluids at 250 F or lower; additional work is being conducted on them.

34319 **APTIC NO. 57533**

Wittenberg, Ervin

PRODUCTION OF ANHYDROUS AMMONIA FROM COAL HOT TREATMENT WATERS. *(Vyroba bezvodeho amoniaku z vod po tepelnem zpracovani uhli). Text in Czech. Ustav pro Vyzkum a Vyuziti Paliv, Prague (Czechoslovakia), Sb. Prednasek 50 (Padesatemu) Vyroci Ustavu Vyzk. Vyuziti Paliv, 1972, p. 152-161. 11 refs.*

Progressive technology for obtaining ammonia from waste dephenoled water in the production of high-pressure fuel gas from brown coal is described. Principal technological parameters of the ammonia production are given; special attention is paid to the stage of production during which a selective separation of ammonia from carbon dioxide is brought about. Some potential failures of the technology presented are described, and methods on how to avoid them are suggested. Development trends and possibilities of applying the process in other conditions are outlined. Special cases of corrosion are also dealt with.

34320 **APTIC NO. 57612**

Dow Chemical Co., Midland, Mich.

EFFECT OF FUEL ADDITIVES ON THE CHEMICAL AND PHYSICAL CHARACTERISTICS OF PARTICULATE EMISSIONS IN AUTOMOTIVE EXHAUST. (FINAL REPORT). *Environmental Protection Agency Contract CPA 22-69-145, EPA-R2-72-066, Program A11010, 371p., Dec. 1972. 19 refs.*

NTIS: PB 222799

A study was undertaken to develop methods of generating, collecting, and analyzing particle emissions from automotive power plants by means sufficiently accurate and reproducible to allow the determination of the effect of fuel additives, fuel composition, engine and vehicle operating mode, and advanced emissions control hardware (limited in scope) on exhaust particle size, concentration, and composition. Measurements were made of the particle emissions from several different engines, loaded by an engine dynamometer, and several different vehicles operated under cruise conditions, the FTP (California) cycle, and the LA-4 cycle. Particle mass measurement techniques included tailpipe measurement methods and air dilution sampling methods using impaction separators, filters, a Beta-gauge technique, and piezoelectric crystal techniques. Several different fuel compositions and fuel additives were examined for their effect on particle emissions. Catalytic exhaust gas reactors were also evaluated for such effects on a limited basis. The data substantiate the applicability and validity of the techniques developed and suggest a significant effect of fuel additives, particularly tetraethyl lead, and, to a limited extent exhaust catalytic reactors, on exhaust particle size, concentration, and composition. The applicability of the techniques to cycle vehicle studies is shown. The second part of the report includes an investigation into the effects of selected dilution tube variables on the physical and chemical characteristics of particulate exhaust emissions, an evaluation of the particle collection capabilities of a second Beta-gauge instrument, and detailed analyses of 30 commercial gasoline samples procured from three different geographical regions of the United States. (Author abstract modified)

34321 **APTIC NO. 57759**

Smelter Control Research Assoc., Inc.

THE REMOVAL OF SULFUR DIOXIDE FROM COPPER REVERBERATORY FURNACE GAS BY WET-LIMESTONE SCRUBBING. *170p., 1972 (?). 18 refs.*

The feasibility of the removal of sulfur dioxide from copper reverberatory furnace gas by wet-limestone scrubbing was investigated. Pilot plant studies and a review of all available information from pilot scale studies and commercial prototype systems in other industries indicate that at its present state of development, wet limestone scrubbing is not a reliable process for removal of SO_2 from copper reverberatory furnace gas. It has a higher downtime than other processes and reliable criteria for scale-up to commercial modules have not been developed. In addition, SO_2 recoveries are lower than those attainable with other scrubbing media and there is a distinct risk that limestone scrubbing may be obsolete before remaining developmental problems can be resolved. It would be more productive to devote research to other processes that avoid the problems inherent in the limestone system and that offer promise of greater reliability and better SO_2 recoveries. (Author abstract modified)

1971

34322 **APTIC NO. 57214**

Bernhardt, W. E.

NITROGEN OXIDE FORMATION IN THE COMBUSTION CHAMBER OF THE INTERNAL COMBUSTION ENGINE AND ITS SUPPRESSION BY MEASURES FROM COMBUSTION TECHNOLOGY. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Conf. Low Pollut. Power Syst. Dev., Eindhoven, Netherlands, 1971, p. VIII-1-VIII-21. 21 refs. (Feb. 23-25.) Translated for the Environmental Protection Agency by SCITRAN, Santa Barbara, Calif.*

Production and decomposition of nitric oxide in the internal combustion engine was investigated, and consideration was given to the kinetics of elementary chemical reactions. A simple mathematical model of nitric oxide formation in the engine was developed, consisting of an appropriate reaction mechanism for the combustion process in the engine and a thermodynamic analysis of the combustion process. Temperature in the region passed by the flame front as well as the velocity constants of the reaction, nitrogen plus oxygen atom forming nitric oxide plus nitrogen atom, were the principal quantities affecting the prediction of nitric oxide formation. Exhaust gas emission measurements on a one-cylinder engine with a modified Volkswagen Type 3 cylinder head and with basic changes in the previous combustion processes, such as stratified charge operation, based on conclusions from the model showed NO at 5-10% and hydrocarbons at 10-25% of the levels observed with conventional combustion processes. It is doubtful, however, whether this method alone will be suitable to attain the drastic reduction of emissions required by the United States after 1975 with retention of good power and economy.

34323 **APTIC NO. 57289**

Brusaglino, G.

STUDIES BY FIAT ON THE ELECTRICALLY-DRIVEN AUTOMOBILE. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Conf. Low Pollut. Power Syst. Dev., Eindhoven, Netherlands, 1971, p. XV-1-XV-7. (Feb. 23-25.)*

Research developments by Fiat in the electrically-driven automobile area are outlined. The initial experiments used vehicles provided with a clutch and gearbox (Fiat 200 van and Fiat 1100 automobile); and the drive system was a compound excitation motor where one of the coils could be supplied independently. The armature had no dissipation element, and velocity regulation depended only on variation of the current in the independently-supplied coil. The system resulted in variable motor velocities in a continuous fashion over a range of values which, through special design features, proved sufficiently broad. Moreover, the system had the possibility of dynamic braking. A nondissipating regulation system was then added to the armature circuit to eliminate the transmission and gearbox. A Fiat 850 model was used for this experiment, and its operational characteristics were judged satisfactory. Presently, a vehicle is being produced which is fitted with a drive system using an asynchronous motor fed by batteries through a static convertor, and plans are in the making for production of hybrid buses with batteries recharged by an electric generating group.

34324 **APTIC NO. 57211**

Cairns, Elton J.

RESEARCH AND DEVELOPMENT ON A LITHIUM-SULFUR BATTERY. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Conf. Low Pollut. Power Syst. Dev., Eindhoven, Netherlands, 1971, p. XIII-1-XIII-26. (Feb. 23-25.)*

The Argonne National Laboratory is pursuing the development of a lithium/sulfur battery for all-electric vehicles and has set a goal of attaining a 220 W-hr/kg lithium/sulfur system which uses a liquid lithium anode, a liquid sulfur cathode, and a molten salt electrolyte containing lithium halides. Results thus far indicate that it is particularly important to provide for the removal of the product lithium sulfide (Li_2S) from the reaction site and to supply more sulfur and electrons for reaction without losing any material to the surroundings. Efforts have been made to improve the capacity density by modifying the structure of the cathode current collector; and to date the laminated cathode has yielded the highest capacity densities, while the enclosed laminated structure has shown the best cycle life. Several other areas of investigation have also been pursued and include phase equilibrium investigations, wetting properties of various solids by sulfur and by electrolytes, and the suitability of solid lithium-ion conductors for use as electrolytes. Results thus far have shown that electric vehicles based in lithium/sulfur batteries can be expected to have ranges of 150-250 km, if 25% of the curb weight of the vehicle is allotted for batteries.

34325 **APTIC NO. 57586**

Downs, W.

EQUIMOLAR NO-NO_2 ABSORPTION INTO MAGNESIA SLURRY - A PILOT FEASIBILITY STUDY. *Babcock and Wilcox Co., Alliance, Ohio, Alliance Research Center, Environmental Protection Agency Contract 68-02-0022, Proj. Order 4193-01, Rept. 4653, Rept. EPA-650/2-73-015. Nov. 19, 1971. 12 refs.*

NTIS: PB 223579/AS

The feasibility of absorption of equimolar concentrations of nitrogen oxides into magnesium oxide slurry on a 1500 cfm wet scrubbing pilot plant was studied. The wet scrubbing pilot plant consisted of several scrubbers and was modified by the inclusion of an additional scrubber to enable series scrubbing of fly ash, sulfur dioxide, and NO_x. Gaseous nitrogen dioxide was injected into the flue gas following the SO_2 scrubber but before the NO_x scrubber. Seventeen tests were performed to evaluate parameters including the liquid-to-gas ratio, the ratio of NO_2 to nitric oxide, slurry concentration, stoichiometry, and gas flow rate. The NO_x absorption was very poor for all conditions tested and was estimated as less than 10%, though the results were obscured by large variance in the NO_x measuring techniques. Sulfur dioxide absorption in the NO_x scrubber was dependent upon the liquid-to-gas ratio and varied from 86 to 98.3%. Deposition on the underside of the first tray of the SO_2 scrubber was also observed. Nitrogen oxides absorption with equimolar concentrations of NO and NO_2 in MgO slurry is not feasible in the apparatus tested and is probably not feasible in any practical gas-slurry contacting apparatus. The MgO slurry should be removed from those bases being considered for aqueous NO_x absorption. (Author abstract modified)

34326 **APTIC NO. 57261**

Gaefgen, K.

LACQUERING AND ENVIRONMENTAL PROTECTION, AS DEMONSTRATED BY THE EXAMPLE OF WASTE WATER TREATMENT IN LACQUERING SHOPS, AND OF SCRUBBING LACQUER SPRAY IN SPRAY

BOOTHS. (Lackieren und Umweltschutz. Am Beispiel der Aufbereitung von Abwasser aus ET- lackieranlagen und des Auswaschens von Farbnebeln in Spritzlakieranlagen). Text in German. Ind. Lackier Betr., 39(6):231-235, June 1971.

Problems of water and air pollution abatement in lacquering shops are demonstrated by examples. Spray booths are equipped with exhaust systems for the removal of spent air which may contain up to 50% of the total lacquer expenditure in the form of lacquer spray. Lacquer is then removed from the air by means of scrubbers, e.g., cascade system, no-pump system, or venturi system, using water as wash liquid. With initial lacquer concentrations ranging from 0.9 to 4.85 g/cu m, purification efficiencies well over 99% can be reached. The waste water from the washer, containing separated lacquer particles, is chemically coagulated from water purification.

34327 **APTIC NO. 57479**

Hejny, Slavomil

THE CHARACTERISTIC FEATURES OF VEGETATION OF SLAG AND FLUE-DUST SUBSTRATES IN PRAGUE. *(Charakteristicke znaky vegetace na skvarovych a popilkovych substratech v Praze). TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 39-42. (Sept.)*

The characteristic features of vegetation and the predominance of certain species among various communities are reported for various locations in Prague where slag and flue dust serve as substrates. The formation of relatively rich stands, with Sisymbrium loeselii or S. altissimum being the prevalent species, appears to present an opportunity for using this initial community as a binder for flue-dust surfaces. Comparison of slag and flue-dust substrates indicates that some weak species for other initial communities (sand and saline soils) grow very well on the first mentioned substrates, and it is suggested that great numbers of these species be planted on industrial substrates in various parts of Europe.

34328 **APTIC NO. 57396**

Houghton, F. R.

THE REMOVAL OF ODOURS AND OBNOXIOUS SUBSTANCES FROM AIR BY ACTIVE CARBON. *Preprint, National Society for Clean Air, Brighton, England, p. 27-43, 1971. 15 refs. (Presented at the National Society for Clean Air Conference, Folkestone, England, Nov. 2-5, 1971.)*

The removal of odors and obnoxious substances from air by active carbon is discussed. Many of the solvents which are used in industrial processes as the manufacture of synthetic textiles and in the dry cleaning and rubber spreading trade are volatile and cause hazards due to toxicity and explosion potential. Activated carbon is often employed for recovery and reuse of a high proportion of the solvent contained in the air stream. Activated carbon is useful in the removal and recovery of sulfur from flue gas. The sulfur dioxide is absorbed and oxidized to ozone which is more readily adsorbed. When the carbon is saturated with high concentration of SO2, the carbon can be regenerated with an inert gas and the SO2 can be recovered and converted to sulfuric acid or elemental sulfur. The control of pollution from exhaust gas, and fuel evaporation from motor vehicles can be achieved through a special adsorption/desorption device containing activated carbon. Other applications of activated carbon include prevention of radioactive iodine emissions, mercury vapor traces from air and gases, in respirators and gas masks, and air conditioning appliances.

34329 **APTIC NO. 57216**

Morgan, Dean T.

RANKINE-CYCLE POWER SYSTEM WITH ORGANIC-BASED FLUID AND RECIPROCATING EXPANDER FOR LOW EMISSION AUTOMOTIVE PROPULSION. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Conf. Low Pollut. Power Syst. Dev., Eindhoven, Netherlands, 1971, p. VI-1-VI-72. (Feb. 23-25.)*

Design specifications, operational characteristics, and emission test data are presented for the Rankine-cycle automotive power system. The system offers a very strong potential for minimum emissions of particulates, unburned hydrocarbons, nitric oxide, and carbon monoxide; and use of Fluorinol-85 as a working fluid, with a moderate maximum cycle temperature of 550 F, permits a significant cost reduction relative to the equivalent steam system. This reduction may permit the Rankine-cycle system to be competitive costwise with the equivalent internal combustion engine system, particularly since the stricter emission level standards will require significant cost increases in the latter system. Emission levels for the Rankine-cycle system are lower than projected 1980 standards by a factor of five for unburned hydrocarbons, by a factor of 13 for CO, and by a factor of 1.6 for NO emission.

34330 **APTIC NO. 57215**

Ortegren, Lars G.

STIRLING ENGINE ACTIVITIES AT UNITED STIRLING (SWEDEN). *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Conf. Low Pollut. Power Syst. Dev., Eindhoven, Netherlands, 1971, p. VII-1-VII-5. (Feb. 23-25.)*

A 200 hp Stirling-cycle engine produced by United Stirling and named 4-615 (four cylinders, 615 cu cm of swept volume per cylinder) appears promising for use in city buses and other heavy-duty vehicles. The engine achieves remarkably low exhaust emission levels and noise levels and is considerably reduced in size as compared to the present state of the art. The 4-615 engine is a four cylinder, displacer type engine with rhombic drive; nominal power output is 200 hp at 2400 rpm at the main output shaft. A two-phase vehicle development project has been initiated to make possible a near-future commercial realization of Stirling engine-powered buses.

34331 **APTIC NO. 57260**

Quitter, V.

ON THE PURIFICATION OF NICKEL PRODUCTION-GENERATED ARSENIC- CONTAINING WASTE GASES. *(Ueber die Reinigung arsenhaltiger Abgase bei der Nickelproduktion). Text in German. Luft. Kaeltetech., vol. 4:187-188, 1971. 3 refs.*

A technique developed for the removal of arsenic waste from gases generated by nickel production is described. The arsenic hydride developing during the roasting and smelting of arsenic-containing nickel ores sublimes into arsenic trioxide at high temperatures. The hot, arsenic-containing waste gases from the reverberatory furnace are cooled to 90-100 C by the addition of secondary air, and then passed through a three-stage horizontal electrostatic precipitator. Part of the electrostatic precipitator can be switched off during breakdown, and the other section can continue normal operation. With an initial arsenic concentration of 2-3 g/N cu m, are arsenic separation efficiency of 99% and over can be reached.

34332 **APTIC NO. 57217**

Witteveen, R. A. J. O., van and N. V. Philips

THE STIRLING-CYCLE ENGINE. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Conf. Low Pollut. Power Syst. Dev., Eindhoven, Netherlands, 1971, p. V-1-V- 23. (Feb. 23-25.)*

The Stirling engine has been developed and tested as a promising candidate for alternative, clean-burning, vehicle propulsion. The engine s power piston and displacer are enclosed by a heater head, a composite unit comprising the burner, heater tubes, preheater, and regenerator. Combustion is continuous and occurs in a space completely surrounded by hot walls of 700 C, resulting in a complete absence of quenching effects and complete combustion. The amount of excess air can be chosen freely so that the design has a considerable measure of flexibility. The amount of oxides of nitrogen formed is very low despite the rather high flame temperature due to the avoidance of local hot spots and short burner residence time. Emissions tests for hydrocarbons, carbon monoxide, and oxides of nitrogen indicate levels substantially below those required by the 1975-76 standards. The engine may be utilized for either light-duty or heavy-duty vehicular application and compares quite favorably with the 13-mode California emission cycle for the latter classification.

34333 **APTIC NO. 57218**

Wright, Edward S.

THE POTENTIAL OF THE GAS-TURBINE VEHICLE IN ALLEVIATING AIR POLLUTION. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Conf. Low Pollut. Power Syst. Dev., Eindhoven, Netherlands, 1971, p. IV-1-IV-24. 18 refs. (Feb. 23-25.)*

Properly designed gas turbine engines for vehicular applications offer significant potential for alleviation of reciprocating engine-caused air pollution. This potential is represented by a predicted total emission level of only 2-4% of that characteristic of untreated gasoline reciprocating engines and only 15-30% of that of reciprocating engines meeting proposed 1975 emissions standards. Motor vehicle contribution to pollution would probably be reduced from 60 to 2% if all Otto cycle engines were replaced by gas turbines. General Motors has released data indicating that the cost of automobile gas turbine engines would be approximately three times that of an untreated reciprocating engine and from one and a half to two times that of an eventual, pollution-treated reciprocating engine. Methods of reducing this level of manufacturing cost would appear mandatory in order for the gas turbine to replace reciprocating engines in quantities sufficiently large to have a significant effect on air pollution levels.

1970

34334 **APTIC NO. 57401**

Breaux, James C.

CONTROL OF PARTICULATE MATTER IN ASPHALT PLANTS. *Preprint, Louisiana Tech Univ., Continuing Engineering Education Div., p. 80-91, 1970. (Presented at the Institute on Aspects of Air Pollution Control, Ruston, La., Oct. 8-9, 1970.)*

Methods for the control of particulate matter in asphalt plants are reviewed. The aggregate, which constitutes about 95% by weight of the finished product, normally contains between 4-8% fines which left uncontrolled could be discharged to the atmosphere. The principal dust generating points of a hot-mix asphalt plant are: the rotary dryer, transfer points, bucket elevator, screens, mixing, aggregate piles, and roadways. The rotary dryer is by far the largest source of dust. Mechanical cyclones, which are now standard equipment on asphalt plants, will remove at best about 80-85% of the material discharged from the dryer and collected via the fugitive dust system. Hence, high performance secondary control systems are required. Two types of wet scrubber designs which have achieved good results are the dynamic centrifugal and venturi scrubbers. Fabric filter collectors have been used with success on asphalt plants, although two main factors hindering optimum collection efficiency are moisture and temperature of the gas stream. Temperature is no longer a limitation with the development of new heat-resistant fabrics which can withstand up to 425 F. Costs of baghouses are about twice that of scrubbers and represent about 25-30% of the total plant cost.

34335 **APTIC NO. 57348**

Dupre, Fred A.

PARTICULATE COLLECTION EQUIPMENT. *Preprint, Louisiana Tech. Univ., Ruston, La., Continuing Engineering Education Div., p. 193-213, 1970, (Presented at the Institute on Aspects of Air Pollution Control, Ruston, La., Oct. 8-9, 1970.)*

Principles of operation, operating parameters, and applications are considered for the four basic types of particulate collectors: electrostatic, dry mechanical, fabric, and wet. The major reasons for selecting an electrostatic collector are: high collection efficiency (99% plus); very low pressure drop (less than one inch); and the ability to handle large gas volumes and collect material in a dry state. Dry centrifugal collectors are appropriate where the collection of large particulates would be a nuisance, where precleaning to reduce maintenance of the final collector is desired, and where reduction in the amount of sludge disposed is needed. Fabric collectors will provide 99% efficiency on particulate matter and will allow recovery of the product in a dry state. They also allow recirculation of the air back into the plant where toxic materials are not present. Wet collectors are selected based on cost when a higher efficiency than dry centrifugal can give is required and a medium pressure drop is adequate. They also are appropriate when the nature of the gas stream or contaminant precludes the use of other collector types, when the dust would represent a fire of explosion hazard, or when the collected materials are more easily disposed of or returned to the process in slurry form.

34336 **APTIC NO. 57512**

Maas, F. M.

GREEN ZONES IN SPACE PLANNING. *(Groenzones in ecnn planologisch kader). Text in Dutch. Bouw, 25(41):1539-1544, Oct. 1970. 4 refs.*

The signifiance of green zones and green belts in creating a better environment is emphasized, and actual plans for the establishment of green zones in the Netherlands are described. Green zones, green belts, and even lines of trees along streets and highways are able to effectively reduce gaseous and especially particulate pollution, radioactive pollution, and noise, and offer a pleasant, esthetic view. Dust concentrations of 1180-3260 in parks, of 3040-3870 in avenues, and of 13,200-18,370 in the center city of Frankfurt am Main were measured. Gaseous pollutant concentrations are effectively reduced by green belts of 2 to 4 km in breadth. Adjacent industrial and residential areas should be separated by buffer zones in order to minimize pollutant transfer. The distance between industrial and residential areas should be at least 3.5 km.

34337 **APTIC NO. 56999**

Varshavskiy, I. L., B. F. Koney, V. B. Klyatskin, and Nami Lane

COMPARISON OF THE TOXIC EMISSIONS FROM ZIL-130 ENGINES WITH SPARK AND FLAME IGNITION. *(Sravneniye toksicheskikh vybrosov dvigateley ZIL-130 s iskrovym i fakel nym zazhiganiyem). Avtomob. Prom., no. 4:3-4, 1970. 5 refs. Translated from Russian. Translation Consultants, Ltd., Arlington, Va., 8p.*

Carbon monoxide, oxides of nitrogen, aldehydes, hydrocarbons plus individual olefins), and benzypyrene were determined in a comparison of the toxic emissions from automobile engines using flame ignition versus spark-type ignition. Carbon monoxide emissions for the pre-combustion flame-type ignition engine were found to be lower than those from the spark type engine by a factor of 10, while NO emissions for the flame type were somewhat higher over the 83-100% interval of maximum engine power. Recirculation of 10% by weight of the exhaust gases, however, reduced the flame engine s NO emissions by a factor of 5 without significant increase in the CO emissions and with an increase in fuel consumption of no more than 1.5%. The flame engine also exhibited rapid growth in the emission of hydrocarbons and aldehyde (formaldehyde being predominant) when the fuel mixture was leaner than the limit of effective leaning. Benzypyrene was found in the flame ignition engine only when the engine was running at maximum, and limiting the power of the precombustion chamber engine by a few percentage points was sufficient to eliminate the carcinogen from the exhaust. The spark ignition engine exhibited benzypyrene over its entire load range.

1969

34338 **APTIC NO. 57153**

Freshwater, D. C.

SOME CURRENT PROBLEMS IN FILTRATION. *Filtration Separation (Purley), 6(2):142-149, 172, March/April 1969. 31 refs. (Presented at the Filtration Society, London, England, Oct. 1, 1968.)*

Filtration processes and the problems associated with them are surveyed. The two types of filtration operations are solid/liquid separation and solid/gas separation. The first includes the stages of pretreatment using applied force with gravity, vacuum, pressure, and centrifugal filters. Solid/gas filtration is concerned with dust collection followed by bag filtration, wet scrubbing, cyclone separation, electrostatic precipitation of high efficiency filters. The structure and nature of the packed beds important in deep and cake bed filtration are discussed. A better understanding of packed beds can be obtained through statistical models, but a number of problems remain, such as the effects of the support on the bed geometry and the effects of concentration, build-up rate, and pressure on bed structure. Research is needed to produce predictions of the effects of electrical surface forces which exert considerable influence on some deep bed filtration systems. In the filtration of dusty gases, particles may be captured by impact, inertia, or diffusion. The problem of particle retention still remains, since they may be removed from the filter by loss of charge or local velocities.

34339 **APTIC NO. 57564**

Fritzon, Lars

ON DESULPHURIZATION AND REMOVAL OF SULPHUR FROM SMOKE GASES IN JAPAN. *(Japansk satsning pa avsvavlingsutrustning). Text in Swedish. Kem. Tidskr., 81(3):22-26, 1969.*

Research shows that sulfur dioxide from combustion of oil will increase linearly in Japan. Various methods of desulfurization are presented, including direct sulfurization of residual oil, desulfurization of heavy crude oil, removal of sulfur from smoke gases, the DAP-Mn dry process using activated coal, and a wet process for removal of sulfur from smoke gas. The economics of sulfur recovery also are discussed. Heavy crude oil may be desulfurized directly in two ways; through hydration of the sulfur in the oil in a stable situation, or through a circulation process. Heavy crude oil also may be desulfurized through the UOP-RCD Isomax process. Sulfur can be removed from smoke gases through a dry method specifically geared toward the problem of electrical power plants. Two methods are employed; absorption with activated manganese oxide, or adsorption with activated coal. Two wet methods, the ammonia process and the lime process, are used in sulfuric acid industries and metal refineries. In 1975, Japan s need for crude oil for energy will be 260 million tons.

34340 **APTIC NO. 57592**

Jordon, Jack B. and Maurice Shafer

WESTERN CANADA S NEWEST LIME PLANT - A GOOD NEIGHBOR TO NATIONAL PARK. *Pit Quarry, 61(11):134-139, May 1969.*

In November of 1967, a new 200 tons/day rotary kiln lime plant went on stream at Kananaskis, 50 miles west of Calgary, Alberta, Can. This plant is a part of the operating division of Steel Brothers Canada Ltd. and replaces the old vertical kiln operation known as the Loders lime plant. Because the plant site is adjacent to the Trans-Canada Highway leading to the town of Banff, and also adjacent to Banff National Park, the selection of the basic process and equipment for both calcination and hydration was investigated thoroughly to insure full compliance with strict air pollution control requirements. Subsequent tests have demonstrated clearly that the kiln scrubber exhaust and the washer-preheater exhaust of the hydrator are well within specified limits. Tests show 0.0012 grains per standard cu ft for both kiln scrubber outlet and hydrator washer stack. Exhaust gases are handled by a Ducon UW4 scrubber, equipped with a 150-hp fan. The scrubber water is supplied from a well, drilled near the feed end of the kiln, at a rate of 275 gal/min.

34341 **APTIC NO. 57591**

Kown, B. T.

FRESH THOUGHT ON SO2 REMOVAL. *Power Eng., 73(5):41-44, May 1969.*

A limestone system has been proposed which removes sulfur dioxide from flue gas and recovers elemental sulfur for sale and calcium carbonate for reinjection. The procedure involves limestone injection into the furnace, two-stage dust-gas scrubbing, and the absorbent regeneration by limesoda causticization. The sulfur and CaCO3 recovery system consists of calcium sulfite reduction, calcium carbonation, and Claus-hydrogen sulfide oxidation. This system is economically advantageous because the limestone can be reused, there are no solid-waste disposal problems, and a salable produce is recovered. System economics are described.

34342 **APTIC NO. 57597**

Messner, M. E. and D. A. Kinneberg

USE OF OXYGEN IN COPPER CONVERTING. *Preprint, American Inst. of Mining Metallurgical and Petroleum Engineers, Metallurgical Soc., 13p., 1969. 4 refs. (Presented at the American Institute of Mining, Metallurgical and Petroleum Engineers, Annual Meeting, Washington, D. C., Feb. 17-20, 1969, Paper A69-22.)*

Oxygen converting test work provided sufficiently favorable and reproducible results to warrant installation of the necessary facilities for commercial use of the process at the Utah smelter. All nine converters were modified to permit enrichment of the blast air with oxygen and to provide for pneumatic feeding of concentrate and precipitate. At a smelter treatment rate of 2580 tons per day of concentrate, a precipitate of about 1000 tons/day will be directly smelted in converters using oxygen enriched blast air. The remainder will be smelted in two reverberatory furnaces. Sulfuric acid production will increase by at least 400 tons/day with a significant reduction of sulfur emission to the atmosphere.

34343 **APTIC NO. 57391**

Richter, Edmund

PROCESS FOR PURIFYING AIR. *(Spinnfaser Aktiengesellschaft Kassel-Bettenhausen (West Germany)) U. S. Pat. 3,446,573. 2p., May 27, 1969. 3 refs. (Appl. Feb. 11, 1964, 4 claims).*

Improvements in processes for purifying air by removal of hydrogen sulfide are discussed. Air contaminated with H2S is scrubbed in an aqueous alkaline suspension at a flow speed of at least 30 cm/sec. The scrubbing solution contains 2 to 5% by weight ferric hydroxide and has an alkalinity equivalent to more than 0.2% sodium carbonate. The gas residence time in the scrubber is at least 5 sec. The concentration of ferric hydroxide should be at least 7.5 moles/mole H2S. Elemental sulfur is formed in the suspension. Cobalt and/or nickel hydroxide can be added to the solution to increase the load limit of H2S in the air to be scrubbed.

34344 **APTIC NO. 57198**

Sakabe, Tsutomu

PRESENT STATUS OF TECHNICAL DEVELOPMENTS IN DESULFURIZATION OF WASTE GAS.

(Haien datsuryu gijutsu no kenkyukaihatsu no genjo). Text in Japanese. Nippon Sekiyukyokai-shi (J. Japan Petrol. Inst.), 12(3):182-187, March 1969. 63 refs.

To prevent air pollution by sulfur oxides, especially sulfur dioxide, in waste gas, four major desulfurization techniques have been developed: dry absorption, wet absorption, use of activated carbon, and contact oxidation. Three dry-absorption techniques are used. In one, powdered lime, or dolomite, is fed into a boiler and oxidized, fixing sulfur dioxide in sulfate, which is removed at dust collectors. In one experiment, 1050 C was the best temperature for injecting calcium hydroxide. Since the chemical dose is limited to prevent lime from sticking to a boiler, methods of increasing reactivity of lime are now being sought. Another dry absorption process is based on the fact that oxides of alkali metals such as alkalized alumina or sodium aluminate react to sulfur dioxide on porous media. Sodium carbonate is a good absorbent under the same process as that used in the alkalized alumina method. Manganese oxide in the form of MnOx x nH2O, where x equals 1.5-1.8, and n equals 0.3-1.0, absorbs SO2 well; a demonstration plant using this activated manganese oxide is now in operation in Japan. One frequently used wet-absorption process begins with dry absorption by powdered lime, followed by a wet-absorption tower which includes a lime suspension. Other wet-absorption methods use an ammonia solution. Activated carbon adsorbs SO2, which reacts with oxygen to form sulfuric anhydride and finally sulfuric acid through reaction with water vapor. Reactivation of activated carbon by gas has been accomplished economically. The contact method of SO2 oxidation is utilized for desulfurization and to produce sulfuric acid or ammonium sulfate.

34345 **APTIC NO. 57370**

Squires, B. J.

NEW DEVELOPMENTS IN THE USE OF FABRIC FILTER DUST COLLECTORS.

Filtration Separation (Purley), 6(2):161-170, March/April 1969. 5 refs. (Presented at the Filtration Society, London, England, Sept. 10, 1968.)

Fabric filter dust collectors generally have the highest dust collecting efficiency, although electrostatic precipitators and venturi scrubbers can be designed to have similar efficiencies, but at higher costs. Three types of collectors, i.e., continuous operation tubular filters with mechanical vibration tube cleaning, continuous operation tubular filters with blow-back cleaning system, and continuous operation pressure-type tubular filters with reverse flow suction system of tube cleaning, are discussed. Applications of these collectors and 1968 installation costs are given for the foundry, nonferrous smelting, carbon black, steel, plaster roasting, cement, fluoride gas, and boiler plant gas cleaning industries. The Bourdale rotary filter dust collector is described.

34346 **APTIC NO. 57600**

Stechkina, I. B., A. A. Kirsch, and N. A. Fuchs

STUDIES OF FIBROUS AEROSOL FILTERS - IV. CALCULATION OF AEROSOL DEPOSITION IN MODEL FILTERS IN THE RANGE OF MAXIMUM PENETRATION.

Ann. Occupational Hyg., 12(1):1-8, Jan. 1969. 7 refs.

The effect of inertial particle deposition on the collection efficiency of parallel circular cylinders was calculated for small Stokes numbers. Interference between diffusional and inertial deposition at flow velocities below 100 cm/sec was small. Inertial deposition begins to be effective in the range of particle sizes and flow velocities where the diffusional deposition may be neglected. For large particles and small velocities, collection efficiency may be affected by the sedimentation of particles. The effects of diffusion, inertial capture, and interception on the efficiency of a fan model filter were calculated in the range of maximum penetration. With rising flow velocity, maximum penetration shifted toward smaller values while the selectivity of the filter decreased. Diffusion and interception contribute to collection efficiency at moderate flow velocities.

34347 **APTIC NO. 57383**

Weyher, L. H. E. and H. L. Lovell

HYDROCYCLONE WASHING OF FINE COAL.

TRANS. AIME (Am. Inst. Mining, Metallurgical, and Petroleum Engr.), 244(2):191-203, June 1969. 19 refs. (Presented at the AIME Annual Meeting New York, Feb. 25-29, 1968, Paper TP 68F110.)

The roles of the major operating variables in the hydrocyclone washing of fine coal were investigated. A 5.5 in., 120 deg cyclone was designed and used for the tests. Cyclone throughput and flow-ratio equations were derived on the basis of theoretical considerations as well as by correlation and multiple regression analysis of test data. Multiple regression analysis was also employed to express the product yield and assay response was also employed the product yield and assay response of each size class to variations of the cyclone operating parameters. Data obtained from those tests that were sink-float analyzed were evaluated by means of error curves vs. particle density and size. Results indicate that the separating performance of hydrocyclone washers is predominately controlled by the flow ratio, the vortex-finder clearance, and the solid/slurry ratio of thy feed pulp. The vortex-finder clearance is the most suitable variable for adjusting operating performance, next to the flow ratio. Product yields and ash assays decrease with increasing vortex-finder clearances. Variations of the solid/slurry ratio are accompanies by directly proportional responses of product yield and assays. Field pulp should not contain more than 8-12% solids by weight. The hydrocyclone washer can remove fine coal pyrite. With Sieve bends, shaking tables, and flotation units, hydrocyclone washing could approximate the high recovery efficiencies of coarse coal cleaning circuits.

1968

34348 **APTIC NO. 57164**

Asano, Takayoshi

OPERATION AND MAINTENANCE OF A SLUDGE COMBUSTION SYSTEM USING A FLUIDIZED BED REACTOR.

(Ryudososhiki odei shokyakuro no untenkanri no jisshirei). Text in Japanese. Kogai to Taisaku, (J. Pollution Control), 3(11):31-37, 1968.

A Dorr fluidized bed reactor was operated at the Minamigamou waste treatment plant in Sendai, Japan from Sept. 1966 to June 1967 to obtain design, operation, and maintenance data. With this method, dehydrated sludge cake from vacuum filters is stored in a tank and continuously fed into a reactor. In the reactor, the cake is pulverized, dried, and incinerated in the fluidized bed of silica at 650 to 800 C. After the waste gas from the reactor is preheated, a cyclone removes about 98% of ash from the waste gas; up to 30% water is added to the ash for easy handling. A scrubber removes nearly all the remaining dust. Air flow rate, temperature, and pressure are metered, and equipment is included for controlling the temperature in the reactor and the air flow rate. Raw-sewage sludge and digested- excretion sludge are treated by this reactor in amounts ranging from 92 to 121 kg total solids per hour. Moisture content in the cake varies from 64.9

to 73.2%, and volatile-solids content from 52.4 to 69.3%. The cyclone and scrubber remove 99.4 to 99.9% of the dust from the exit gas. Carbon monoxide in the exit gas is 0 to 0.3% of total exit gas. The cost of operating this system was $0.50 to $0.75 per ton-cake treated.

34349 APTIC NO. 57567

Litvinov, A. T.

INFLUENCE OF ELECTRIC WIND AND GAS HUMIDITY ON THE EFFICIENCY OF PARTICLE COLLECTION IN AN ELECTROSTATIC PRECIPITATOR. *J. Appl. Chem. (USSR) (English translation from Russian of: Zh. Prikl. Khim.), 41(9):1853-1859, Sept. 1968. 11 refs.*

Electrostatic methods for high purification of industrial gases are widely used in chemical technology. Increasing the degree of gas purification is a complex and urgent problem. The principle of electrostatic precipitation can be stated briefly. When a particle enters the active zone of an electrostatic precipitator, it becomes charged in a very short time by a stream of ions moving at high velocity under the influence of an electric field. The charged particle moves toward the receiving electrode under the influence of forces arising in the active zone and is collected on it. As a result of the rapid movement of negatively charged ions toward the collecting electrode, an electric wind is produced in the active zone. Experimental investigations were carried out using a nepheline concentrate aerosol. Corona current was increased at approximately constant voltage by varying the humidity of the gas entering the precipitator. Evaluations of the experimental data yielded definite dependences of the corona current on the gas humidity, residual dust concentration on the moisture content, and collection efficiency on the corona current. Increasing the corona current increased the electric wind velocity and the effective drift velocity of the particles. This raised the collection efficiency and lowered the residual dust concentration substantially. The electric field intensity and the electrostatic force acting on the particles were approximately constant.

34350 APTIC NO. 57553

Murray, F. E. and H. B. Rayner

THE OXIDATION OF DIMETHYL DISULPHIDE WITH MOLECULAR OXYGEN. *Preprint, Canadian Pulp and Paper Assoc., 4p., 1968. 10 refs. (Presented at the Canadian Pulp and Paper Association, Technical Section, Annual Meeting, Montreal, Quebec, Jan. 23-26, 1968.)*

In an investigation of the reuse of contaminated water at a kraft pulp mill, the oxidation of odorous methyl mercaptan compounds through the disulfide stage to methanesulfonic acid was explored. The rate and mechanism of oxidation of dimethyl disulfide with oxygen was studied in the temperature range 25 to 125 C. Residual reactants were determined by use of a gas chromatographic procedure. Results indicated that the overall rate of oxidation of dimethyl disulfide is controlled by a combination of oxygen mass transfer rate and the rate of chemical reaction. The mass transfer of oxygen is probably liquid film. The oxidation rate at 100 C was low in acid and neutral solution but proceeded well in alkaline solution. Alkaline hydrolysis of dimethyl sulfide proceeded to a considerable extent at 100 C. For this oxidation to be effective in air pollution control, the pure oxygen in a pressurized reactor must be used. If oxygen is supplied as part of an air stream, too much mercaptan and dimethyl sulfide will be stripped from waters before oxidation can be effected.

34351 APTIC NO. 57869

Nabivach, V. M., S. S. Yatsenko, and V. S. Kovalenko

THE ABSORPTION CAPACITY OF WASH OILS. *Coke Chem. (USSR) (English translation from Russian of: Koks i Khim.), no. 8:35-38, 1968. 5 refs.*

Distribution coefficients were used to make a comparative evaluation of the absorption capacity of wash oils in removing aromatic hydrocarbons from coke oven gas. Fresh coal tar oils and debenzolized oils had the highest distribution coefficients. The absorption capacity of the debenzolized coal tar oils was 10% lower than that of the fresh oils. The absorption capacity of solar oils, with respect to the main constituents of crude benzol, was 40% less than that of coal tar wash oils.

34352 APTIC NO. 57365

Nagano, T. and M. Niimura

FEATURES OF THE ONAHAMA COPPER SMELTER BOILERS BEHIND CONVERTERS. *J. Metals, 20(7):76-81, July 1968.*

In reverberatory smelting, the grade of matte produced in the furnace depends on the preliminary treatment of the copper concentrates. The main disadvantage of wet reverberatory operation is the increased cost of converting due to the lower grade of matte. The major portion of this cost consists of the power which is required to blow compressed air into the converters. Although the sensible heat in exhaust gases from the process is calculated to be more than the power required for blowing air, the difficulties of heat recovering facilities have retarded effective utilization. Specially designed converter hoods that prevent leakage of cold air into the exhaust gas must be incorporated if a high efficiency of heat recovery is to be obtained. Recovery is implemented by installing waste heat boilers behind the converters. At normal smelting rates, the boilers at Onahama produce about 95,000 lbs of steam per hr at 540 psig and 734 F. Although the flow fluctuates widely, the amount of steam generated is enough to drive the turbine supplying air to the converters. To make up time differences between the converter air and the generation of the steam, steam accumulators are installed. The smelter has been in operation for three years and is producing more than the planned 5500 short tons of electrolytic copper per month. Sulfur dioxide in the exhaust gas is recovered as sulfuric acid.

34353 APTIC NO. 57672

Pilney, J. P. and E. E. Erickson

REMOVAL OF FLY ASH BY FLUIDIZED BED TECHNIQUES (FINAL REPORT). *North Star Research and Development Inst., Minneapolis, Minn., Bureau of Mines Contract 14-09-0070-375, 58p., March 8, 1968. 45 refs.*

Fly ash can be removed effectively by passing an ash-containing gas stream through a shallow bed of fluidized particles. Mass efficiencies greater than 99% have been obtained in a 4-inch diameter glass column with fly ash loadings as high as 10 grains per cubic foot of entering air. If inertial impaction were the controlling removal mechanism, a 99% mass efficiency could correspond to a number efficiency of removal of about 40% of the particles. However, other forces, such as electrostatics, appear to be important in the fluidized bed, and the difference in mass and number efficiencies may not be that great. Superficial gas velocities as high as 2 ft/sec and pressure drops as low as 0.5 in. of water gave good results. The ash used had a mass median diameter of 8 micron, and a number median diameter of 0.7 micron. All three mechanisms studied--self-agglomeration in humidified air, coating the surfaces of sticky particles, and build up of fly ash on the surface of other particles--can be used to remove fly ash. The most attractive direction fur further development is the use of larger, more dense particles in the bed to permit high throughput. Electrostatically charged particles and, perhaps, sticky particle surfaces should enable the filter to operate efficiently even under the high flow conditions. The process would be adaptable to continuous operation.

34354 APTIC NO. 57596

Rushton, A. and D. J. Green

THE ANALYSIS OF TEXTILE FILTER MEDIA. *Filtration Separation (Purley), 5(6):516-523, Nov. 1968. 7 refs.*

The quantitative measurement of the flow characteristics of the clean medium is necessary to gain an understanding of the role of the filter medium in a filtration process. The division of fluid flow through and around the yarns of the cloth must be taken into account to describe the specific permeability of a textile filter cloth. It is possible to correlate flow data in terms of the diameter of the fibers in the yarns in tightly woven cloth where the flow is predominantly through the yarns, but in loosely woven cloth, the flow will generally be directed around the yarns and the yarn diameter becomes more important. The distribution of the fluid flow is determined by the distribution and size of the interyarn and interfiber pores. An estimate of the pore size can be made if the division of flow can be experimentally determined. A method of calculating the pore size of a woven filter cloth, taking into account the division of flow, is given. The results are compared with pore size measurements made by other methods and the limitations of each method are discussed.

34385 **APTIC NO. 57560**

Terrana, J. D. and L. A. Miller

NEW PROCESS FOR RECOVERY OF SO2 FROM STACK GASES. *Preprint, 19p., 1968. 4 refs. (Presented at the American Power Conference, Annual Meeting, 30th, Chicago, Ill., April 1968.)*

The Wellman-Lord sulfur dioxide recovery process is a new concept in which a wet scrubbing system, combined with a chemical reaction plus a change in chemical form, produces a regenerative system for the recovery of pure, dry liquid SO2, elemental sulfur, or sulfuric acid. This is the first process to give a favorable economic return on the recovery of SO2 from stack gases, and it can be used by any plant which has SO2 in its effluent gas. In the first step, the flue gas is processed in the reactor to remove 99% of the fly ash and sulfur trioxide and 90-99% of the SO2. The reactor area is also designed to remove chemical entrainment in the flue gas. After leaving the reactor area, the flue gas is discharged to the stacks at 140 F and a velocity of 70-90 ft/sec with almost all the sulfur oxides and fly ash removed. The chemical solution from the reactor is fed to the special treatment area, where the SO2 is removed in a patented process. In the final step, a stripper column is used to separate SO2 from the product by means of steam stripping. The column is arranged so that a ratio of 4 lbs of steam/pound of SO2 produced is obtained. The chemical is regenerated to its original state and recycled to the special treatment area. Steam overhead from the column is condensed and recycled to the special treatment area. The SO2 vapor from the K.O. drum is compressed and fed to a distillation column, then condensed overhead with water. Part of this liquid SO2 is refluxed to the column, and the remainder is fed to storage. Depending on its area of location, the SO2 can be converted to elemental sulfur or to sulfuric acid. Wellman-Lord is now negotiating to build a 25 and 100-megawatt plant. With the completion and operation of these plants, the size of the power plant that can be converted for using this process will be unlimited.

1967

34386 **APTIC NO. 57183**

Attig, R. C.

DISPERSED-PHASE ADDITIVE TESTS FOR SO2 CONTROL. PROGRESS REPORT ON PILOT PLANT INVESTIGATION TO EVALUATE THE POTENTIAL OF DIRECT LIMESTONE-DOLOMITE ADDITIVE FOR CONTROL OF SULFUR DIOXIDE FROM COMBUSTION FLUE GAS. *Babcock and Wilcox Co., Alliance, Ohio, Research Center, Public Health Service, Contract PH86-67-127, LR-67-4078-01-5 (ES-9477), 23p., Nov. 30, 1967. 1 ref.*

A study concerned with determining the reactivity of limestone and dolomite with sulfur dioxide is discussed. Fourteen limestones, eight dolomites, and two hydrates were injected into the flue gas of a coal-fired pilot plant at approximately 2400 F to determine their effectiveness in reducing the SO2 level. Four of the limestones and one dolomite were also injected at a lower temperature of about 1900 F. The SO2 level in the flue gases was monitored throughout the coal-firing period. Continuous infrared analysis is normally used, but because of instrument failures, a batch-type wet chemical technique was used during a number of the tests. Effectiveness in reducing the SO2 level varied between 2 and 31%. The limestones and dolomites were more effective when injected at the higher temperatures, whereas the hydrates tested were more reactive at lower temperatures. Dolomites were more effective than limestones in general, indicating that magnesium had a role in reducing SO2 level although no magnesium sulfate was identified by x-ray analysis of the fly ash-additive mixtures. This information will be used as a base later for comparison with coal ash-additive mixtures to estimate the effect of additives on ash deposition and furnace wall slagging.

34387 **APTIC NO. 57654**

Elvander, Hans I.

THE BOLIDEN LEAD PROCESS. *Pyrometallurgical Processes in Nonferrous Metallurgy, vol. 39:225-245, 1967. 8 refs. (Presented at the American Institute of Mining, Metallurgical, and Petroleum Engineers, Metallurgical Society, Pittsburgh, Pa., Nov. 29 - Dec. 1, 1965.)*

The Boliden process of smelting rich lead sulfide concentrates is used at the Company's smelter, Ronnskarsverken, Skelleftehamn. Lead concentrate, 235 metric tons per day, with an average lead content of 75% is directly smelted in an electric furnace, heated by four Soderberg electrodes in a row. The furnace was previously used for processing semidesulfurized lead sinter according to the roast reaction principle. Application of direct smelting required only minor modifications to the furnace comprising raising of the roof to a height of 5.5 feet above the bath level and arranging of nozzles for the combustion air in order to form vortices in the space between two pairs of electrodes. The amount of dust in the gas leaving the furnace is 100 tpd. It is precipitated in a waste heat boiler and cottrell filter and continuously returned to the furnace. The cleaned gas is used for production of sulfuric acid. A calcium oxide-content in the slag of 34%, together with an addition of coke breeze to an amount of 5.5% of the slag weight, limits the lead content of the slag to 4.0-4.5%, corresponding to 1.1% of the lead going into the process. The zinc oxide-content is around 20%. The liquid slag is transferred to a slag fuming plant adjoining the copper works. Lead from the furnace contains around 3% sulfur. Converting of the lead is maintained in order to decrease S content, cool the lead, and separate dross from lead. The dross, amounting to 30 tpd is crushed and returned to the furnace. Consumption of electric energy amounts to 810 kWh per metric ton of refined lead at continuous production. Total recovery of refined lead approaches 98%. (Author abstract modified)

34388 **APTIC NO. 57371**

Goldschmidt, K.

EXPERIMENTS FOR REMOVAL OF SULPHUR DIOXIDE FROM FLUE GASES. *Preprint, 21p., 1967. 4 refs. (Presented at the Limestone Symposium, 3rd, Clearwater, Fla., Dec. 4-8, 1967.)*

Experiments were carried out to investigate the activity of slaked lime (calcium hydroxide) and hydrated dolomite (Ca(OH)2 Mg(OH)2) for desulfurizing flue gases at oil and pulverized coal-firing. The construction of the pilot plant is described. Three tests were run. In the first test, the mixing of slaked lime and pulverized coal did not permit any appreciable SO2 removal, and the boiler was heavily dirtied. Formulas for theoretical and actual sulfur removals are given. The second test injected lime and dolomite in pulverized coal-firing. This resulted in less boiler dirtying and higher SO2 removals than in the first test. Lime was essentially more effective than dolomite. In the third test, the boiler was converted to oil firing and lime and dolomite were injected. Greater SO2 removal for both lime and for dolomite were measured than with pulverized coal firing, and there was no coating action of fly ash. In the injection studies of pulverized coal-firing, the SO2 content was reduced quickly and remained constant during the remainder of the test period only. Injection caused SO2 flue gas content to decline continually in oil-firing boilers. Greater quantities of lime resulted in maximum deposits after 2 hr. Eight diagrams show experimental equipment and the resulting data.

34359 APTIC NO. 57226

Hoar, Francis J.

SYSTEM FOR RECOVERING RELIEF GASES FROM A SULPHITE PULP DIGESTER. *(Assignee not given.) U. S. Pat. 3,313,680. 5p., April 11, 1967. 3 refs. (Appl. Dec. 4, 1963, 3 claims).*

A method of recovering relief gases for use in manufacturing the cooking acid needed in pulp production has been developed. The overgas from the various recovery stage vessels is returned to a pressure recovery tower, and the gas is then discharged to the bisulfite raw acid making system. This system eliminates stripping in successive vessels by the overgas, since these overgases are absorbed in the recovery tower, where they flow counter to the raw acid at low sulfur dioxide concentrations and temperatures. The cycling of inert gases produced in the cooking process would strip SO2 from the acid in storage tanks. The stripping effect is eliminated by removing the inert gases in the overgas from the pressure recovery tower. Cold, low strength raw acid is made available in the pressure recovery tower to absorb the SO2 contained in the pressure storage tank overgas and in the digester relief gas. This system eliminates the need for a gas holder and for an absorption tower. The recovery plant is used to recover SO2 to fortify the raw acid. In this way a desirable cooking acid can be obtained. A flowsheet illustrating the operation of this system is included.

34360 APTIC NO. 57594

Jackson, C. R., J. Knoerzer, and M. O. Holowaty

LOW GRAVITY SEPARATION–KEY TO BENEFICIATION OF ILLINOIS COAL. *J. Metals, 19(1):58-61, Jan. 1967.*

Illinois No. 6 coal is a high-volatile, Bituminous coal made up of 9.0% moisture, 37.5% volatile matter, 52.5% fixed carbon, 10.0% ash, and 1.3% sulfur. The distinct nature of the various constituents of this coal makes it suitable for beneficiation processes. After it was determined that impact crushing liberated the individual petrographic constituents, a series of laboratory tests was conducted to determine whether these constituents could be separated by gravity separation (froth flotation). The test indicated that a more efficient separation was achieved by means of gravity separation than by screening. Since blast furnace operators wanted cokes of lowest possible ash content, a goal of 5.5% ash was set for the eventual metallurgical coal product. A study was undertaken to determine the washability characteristics of run-of-mine coal and the effect that crushing had on these characteristics. This study showed that the percentage of low ash which could be recovered by means of gravity separation could be increased by crushing. The washability of the 3 by 1-inch fraction of run-of-mine coal indicates a 65% yield of 5.5% ash coal at a specific gravity of 1.35. The 3 million tons/yr mine is expected to produce 65% metallurgical coal at 5.5% ash, 20% steam coal at 11% ash, and a maximum of 15% reject.

34361 APTIC NO. 56998

Kerimov, N. A. and R. I. Mekhitiyev

A FUEL INJECTION ENGINE WITH PRECOMBUSTION CHAMBER IGNITION. *(Dbigatel s vpryskom topliva i forkamerno-fakel nym zazhiganiyem). Avtomob. Prom., no. 1:8-11, 1967. 2 refs. Translated from Russian. Translation Consultants, Ltd., Arlington, Va., 13p.*

The design, operation, and test results are presented for a fuel injection engine with precombustion chamber ignition. Combustion in an engine running with two injectors working in parallel occurs with great stability, even down to deep total leaning of the mixture. Control tests of a one-cylinder engine using the new fuel delivery and ignition system indicate a reduction in the optimum ignition advance angle at all speeds and loads as compared to carburetion and spark ignition. This reduction is a result of the reduction in the total time of combustion for the working mixture in the cylinder. The use of fuel injection increases engine power by 15-20% as compared to carburetion. The proposed method for achieving fuel atomization and ignition will, in principle, provide quality control of power over the entire engine operating range. Further testing of the method is planned for the M-21 engine used in the Volga passenger car.

34362 APTIC NO. 57367

Kruel, M. and H. Juentgen

REACTION OF SO2 FROM FLUE GASES WITH DISPERSED SOLIDS OF CARBONATES AND OXIDES UNDER DEFINITE TEMPERATURE AND RESIDENCE TIME CONDITIONS. *Preprint, 27p., 1967. (Presented at the Limestone Symposium, 3rd, Clearwater, Fla., Dec. 4-8, 1967.)*

By injecting dusty compounds such as dolomite or lime directly into a boiler, sulfur dioxide contained in the flue gas can be reduced. In an experimental boiler plant, bituminous coal was burned in an underfeed smoke type furnace. The flue gas emitted was first dedusted in a cyclone and then passed into a reaction tube. Immediately after the removal of fly ash the dusty material used as a desulfurizing agent was injected into the flue gas. This material reacted with the SO2 forming sulfates which are collected by means of an electric precipitator. The formation of sulfates increases with rising temperature. The reaction takes place in less than one second, especially when calcium carbonate is used as a desulfurizing agent. Longer residence time does not increase the degree of transformation. When using an alkaline substance, such as CaCO3, only 50% of the dust took part in the reaction. Even with a threefold excess of the dedusting agent it is impossible to extract all of the sulfur from the flue gas. It is believed that the incomplete transformation is due to the fact that in the reaction tube the individual grains are coated with a dense film of sulfate which prevents the penetration of SO2 into the core of the grain.

34363 APTIC NO. 57364

Neider, R. F. and W. R. Bain

ELIMINATION OF LEAD AND CADMIUM BY THE FLUID COLUMN PROCESS AT SHERBROOKE METALLURGICAL CO. *Can. Mining Met. Bull. (Montreal), 60(664):929-932, Aug. 1967. 3 refs.*

The process described eliminates substantial cadmium, selenium and lead during the roasting of pelletized zinc concentrates in order to increase the yield of feed for a vertical retort zinc smelter without recourse to a sintering operation. The plant can achieve very low lead and cadmium levels by operation in the following manner. Natural gas admitted via a tuyere bank 15 inches above the hearth supplements the fludizing air admitted via the wind box. Quantities are adjusted to maintain a reducing atmosphere within the interstices of the bed. Bed temperatures remain in the vicinity of 1080 to 1100 C. The zinc content correspondingly increases under these conditions, while 90% of the cadmium and 92% of the lead in the feed are eliminated. Sulfate sulfur decreases by 0.5% and sulfide sulfur is held at 0.6 to 0.08%. The fuel value of the natural gas is recovered as extra steam. Problems with fume accretions, gas conditioning and gas cleaning have not yet been resolved.

34364 **APTIC NO. 57386**

Okazoe, Tokusuke, Toshio Kato, and Kenji Murao

THE DEVELOPMENT OF FLASH SMELTING PROCESS AT ASHIO COPPER SMELTER, FURUKAWA MINING CO., LTD. *Pyrometallurgical Processes in Nonferrous Metallurgy, vol. 39; 175-195, 1967. (Presented at the American Institute of Mining, Metallurgical, and Petroleum Engineers, Metallurgical Society, Extractive Metallurgy Division, Pittsburgh, Pa., Nov. 29-Dec. 1, 1965.)*

The success of the flash smelting process in Finland led the Ashio Copper Smelter to adopt this process. The capacity and efficiency of the electric furnace and other auxiliary equipment were inadequate. The concentrate drying system could treat only 3-4 tons/hr, the furnace was overworked treating half-finished slag from the converter, tubes in the recuperator were corroded by vanadium, concentrate burner efficiency was impaired by the growth of accretions settling below the burner, flue dusts clogged the waste boiler, and lump ores were charged directly in the converter instead of being fed into the drying processes. Measures undertaken to overcome these shortcomings are described. The installation of a small rotary dryer has increased the capacity of the concentrate drying equipment. Corrosion has been reduced by the indirect exchange of steam and air in the waste heat boiler and recuperator system. Heat insulation provided to the converter has decreased the amount of half-finished products from the converter. Due to a decrease in the exhaust gas volume, achieved by utilizing the heated air for oil combustion in the flash furnace, all flue dusts are processed. Sizing equipment installed at the outlet of the cage-mill removes grains larger than 5 mm diameter. As a result, miscellaneous lumps are now easily treated in the flash furnace. Since restrictions on feed material have also been eliminated, it is possible to smelt concentrates containing a sulfur to copper ratio of 0.6 to 1.2. Sulfur recovery from concentrates is as high as 91%.

34365 **APTIC NO. 57602**

Plumley, A. L., J. Jonakin, O. D. Whiddon, and F. W. Shutko

REMOVAL OF SO2 AND DUST FROM STACK GASES. *Proc. Am. Power Conf., vol. 29:592-614, 1967. 15 refs.*

Several methods are available for the control of sulfur dioxide emissions from stack gases. One of these is fuel desulfurization, notably hydrodesulfurization, but this method is not economically feasible. Therefore, the removal of SO2 from stack gases has been studied in great detail. A system utilizing an additive that would form a compound with SO2 and then could be disposed of in a manner similar to fly ash was thought to be a logical approach. A coal-fired boiler can be operated successfully while adding sufficient dolomite to react with all the sulfur present in the coal. The elimination of sulfur trioxide from the furnace is brought about by reducing it with dolomite. This results in control of low temperature corrosion and deposit formation caused by SO3 condensation forming sulfuric acid. A pilot-scale wet scrubber showed SO2 removal can be maintained at a high level. Dust removal efficiency as great as 99.5% can be obtained in the same wet scrubber.

34366 **APTIC NO. 57373**

Tanaka, Kusuyata

DESULPHURIZATION BY LIME. *Preprint, 35p., 1967. (Presented at the Limestone Symposium, 3rd, Clearwater, Fla., Dec. 4-8, 1967.)*

Experiments by a fixed-bed bench-scale apparatus concerning desulfurization of stack gas by calcinated limestone are reported. The tests were conducted to determine effects of calcination temperature, reaction temperature, and particle size on desulfurization rate. Limestones were calcinated in an electric furnace for 3 hr and simulated flue gas introduced. The greatest amount of SO2 was absorbed when the absorbent was calcinated above 1100 C. The optimum reaction temperature was 900 C, and desulfurization rate decreased below 700 C. Sulfur dioxide absorption increased with the fineness of the limestone particle, and table limestone under 200 mesh coincided with that of slaked limestone. Slaked lime desulfurization was greatest at 1050 C. Another test was run on desulfurization by limestone in which the particle size tested was small. The desulfurization rate was proportional to the diameter of the particle. It is estimated that many fine cracks were generated when carbon dioxide escaped by decomposition. Desulfurization by calcium carbonate was inferior to that by slaked lime. Eighteen figures show reaction time, apparatus used, particle size, and temperature effects on desulfurization time. Nine tables present experimental data.

34367 **APTIC NO. 57197**

Vesemark, Emil Teodor

METHOD OF REMOVING NEUTRAL MALODOROUS IMPURITIES FORMED IN SULFATE PULPING. *(Assignee not given.) U. S. Pat. 3,323,289. 3p., June 6, 1967. 4 refs. (Appl. Oct. 16, 1964, 13 claims).*

A method of removing neutral malodorous organic impurities which are slightly soluble in water from an impure medium containing these impurities is presented. These pollutants arise in the manufacture of sulfate cellulose pulp, especially in the vapor liberated during the relieving of the digester and its contents. The method comprises extracting the impure medium with a water-immiscible organic liquid by atomizing the organic liquid into the impure medium. After separating the aqueous from the new impure organic layer, the latter may be destroyed by combustion or processed to recover the sulfur compounds. Four working examples are presented.

1966

34368 **APTIC NO. 57184**

Blair, James C.

FLUOSOLIDS ROASTING OF COPPER CONCENTRATES AT COPPERHILL. *J. Metals, 18(3):324-327, March 1966.*

Addition of a fluosolids roasting unit to the existing smelter equipment increased the tonnage of copper concentrates smelted by 40%, and the recovery of smelter sulfur was increased from 63 to 85%. Operating procedure depends upon the amount of copper concentrates available for roasting and the grade of matte desired. First, flux is added to the copper concentrate in a ratio required to give the desired reverberatory slag analysis. The copper concentrate and sand are then mixed into a slurry, the specific gravity of which is controlled to give the matte grade desired. The volume of air blown is determined by the amount of slurry used, or the amount of copper concentrate smelted over any period of time. Roaster temperatures are maintained at 1100-1200 F, and are controlled by feed rate. If the temperature in the roaster bed rises more feed is added, or if the temperature drops, feed rate is reduced.

34369 **APTIC NO. 57096**

Chertkov, B. A.

KINETICS OF STRIPPING SO2 FROM SOLUTIONS OF AMMONIUM SULFITE- BISULFITE IN PACKED COLUMNS. *Khim. Prom. (Moscow), 42(9):685-689, 1966. 10 refs. Translated from Russian by William C. Hunn, Tennessee Valley Authority, Oak Ridge, Wilson Dam, Ala., 13p., Jan. 1968.*

NTIS: PB-178103-T

The kinetics of stripping sulfur dioxide from solutions of ammonium sulfite-bisulfite by steam heating was investigated. The hydrodynamic conditions of performance of a column packed with 50 by 50 mm rings should be selected such that solution retention time in the hot zone should be 2-3 min. It is recommended that the stripping column design be carried out in the following order. Resulting from the conditions of preparation of a saturated bisulfite solution (PSO2, temperature), the optimum values (2,6) of C and (S/C) where SiC is the ratio of the equilibrium composition of the sollution, are determined. Set to the value of (S/C)k, the stripping temperature, its corresponding value of (S/C) and then the number of transfer units are found. When used with the ratios of (10), (5), and (1), the irrigation density, column surface area, packing volume, and its height are determined in succession. At the end of the design (estimate) the value of pi is checked according to the ratio (15) and the necessary corrections made. (Author summary modified)

34370 **APTIC NO. 57362**

Skelly, Joseph F.

PROFITS IN BOF GAS COLLECTION. *Iron Steel Engr., 43(3):82-88, March 1966. 4 refs.*

A more economical approach than completely burning converter gases in a hood is to recover the gases without combustion. This can be accomplished in steel converters by using the IRSID-CAFL process. Instead of great excesses, only a small quantity of air is utilized so that after combustion, the gas contains approximately 81% of the original C as carbon monoxide and 19% as carbon dioxide. Because of the nitrogen content of the introduced air, final gas mixture is 70% CO, dioxide 16% CO2, and 14% N2. Flame temperature is approximately 3320 F, compared with 4200 F in excess air burning. Heating value of the mixture is about 230 btu/standard cu ft. The smaller amount of gas handled in the process yields lower capital investment in the. gas collecting equipment. Power requirements for the process are about one-third those for complete combustion. Dust collection is 25% greater than with conventional excess air combustion. By-product value of the recovered gas and dust can amount to 43 cents/ton of steel. This may be increased by the utilization of CO as a chemical raw material. (Author summary modified)

1965

34371 **APTIC NO. 57375**

Grosspietsch, Horst, Herbert Kaltenhaeuser, and Otto Heuse

PROCESS FOR REMOVING THE NITRIC OXIDE FROM GASES CONTAINING UNSATURATED HYDROCARBONS. *(Farbwerke Hoechst, A.-G. Frankfurt am Main (West Germany)) U. S. Pat. 3,192,009. 2p., June 29, 1965. 5 refs. (Appl. Jan. 31, 1962, 10 claims).*

The invention describes a process for removing nitric oxide from cracked gases, especially those which contain more than 10% by volume of unsaturated hydrocarbons which are obtained by pyrolyzing hydrocarbons at high temperature. By this process, the nitric oxide included in the gas is transformed into nitrogen dioxide and removed by washing under superatmospheric pressure, but at a low temperature. This process avoids the formation of nitro-resins in gas mixtures where NO exists in a proportion of about 0.001 to 0.2% by volume. The mixture is partially oxidized with the oxygen included in or introduced into the cracking as to form nitrogen dioxide and is then removed by washing during or immediately after compression to about 2 to 50 atmospheres at a temperature of 0 to 30 C immediately after oxygen has been added to the compressed gas. The process is also applicable to other gas mixtures, such as coal distillation gases produced in gas or coke works.

34372 **APTIC NO. 57544**

Guccione, Eugene

FLUIDIZATION TURNS PYRITES INTO HIGH-GRADE IRON ORE. *Chem. Eng., 72(10):142-144, May 10, 1965.*

Fluid-bed technology can upgrade calcined pyrites into iron pellets suitable for blast furnace feed. In one plant, roasting of 2200 metric tons per day of pyrite containing 35 to 39% iron provides enough sulfur dioxide for production of 2200 metric tons per day of 100% sulfuric acid, about 570,000 kwh of electricity, and 1500 metric tons per day of hematitic calcines. By reducing these calcines to magnetite, and performing a wet and dry magnetic concentration, the plant yields 100 metric tons per day of iron-oxide pellets containing 66 to 67% Fe. Roasting of crude pyrites and reduction of calcines is carried out in four separate units, each designed for a feed of 550 metric tons per day of crude ore. Nearly 100% conversion of hematitic calcines to magnetite is achieved by controlling the feed temperature, detention time, air-to-oil, and oil-to-feed ratios. Overall heat heat requirement per ton of Fe2O3 pellets from pyrites is 2.18 million btu, of which 1.43 million btu is used for the reduction step. Energy consumption is about 4 kwh per ton of feed for reduction, and 50 kwh per ton for magnetic separation and pelletizing.

34373 **APTIC NO. 57368**

Kindig, J. K. and S. D. Irons

REPROCESSING BITUMINOUS COAL REFUSE. *Mining Congr. J., 51(7):36-39, July 1965.*

In an attempt to eliminate the problem of air pollution from burning refuse piles, organic combustibles were removed from coal refuse to render it inert to excessive oxidation, heat accumulation, and consequent burning. Research progressed through two phases: the characterization of amount and type of refuse contained in the refuse banks; and conception and evaluation of a refuse processing flow sheet to achieve the desired separation. Investigations are under way to relate the media gravity and cyclone pressure of the effective cleaning gravity and cleaning efficiency.

34374 **APTIC NO. 57113**

Litvinov, A. T.

ENHANCED EFFICIENCY OF CATCHING THE DUST OF HIGHLY DISPERSED AEROSOLS WITH FINE GAS PURIFICATION BY THE WET METHOD. *Energetika (Prague), Translated from Russian, 7p., 1965 (?). 12 refs.*

A method of improving the efficiency of collecting dust particles up to 1 mk (mkm) in size in a venturi tube is described. It consists of operating the tube under condensation conditions, when the input temperature of the gas to be purified is close to the dew point, and the quantity of moisture being condensed assures that a film of optimal thickness is obtained on the dust particles. (Author abstract modified)

34375 **APTIC NO. 57593**

Vogel, hans

THE ELIMINATION OF NITROGEN OXIDES FROM RESIDUAL GASES. *(Die Vernichtung der Stickstoffoxide in Restgasen). Text in German. Chem. Z./Chem. Appl., 89(18):632-635, 1965. 17 refs.*

A review of methods for elimination of nitrogen oxides from waste gases, and of the patients covering these methods, is presented. Methods include condensation through countercurrent mixture with the nitric acid present in the concentrating apparatus in HNO3 manufacture; passage through columns containing nitrogen oxide solvents; combustion over a platinum catalyst; passage over an adsorbing catalyst; irradiation with ultraviolet light; adsorption on charcoal, peat, or coke; absorption in sulfuric acid; absorption in aqueous solutions of NaClO2 or ClO2; adsorption on solid sorbents, e.g., silica gel and alumina-silica gel; passage through a solution of potassium, sodium, and ammonium hydroxides followed by adsorption on a surface-active material, and others. The Engelhard process, in which the substances are reduced to N2, is covered by a number of patents in various countries. The oxides are reduced with ammonia, and then with hydrogen or a hydrocarbon, e.g., methane. The catalysts employed in this process are platinum, rhodium, and palladium. Iron, cobalt, or nickel may be used in the first stage.

34376 **APTIC NO. 57284**

West, James R. and Edward H. Conroy

PROCESS OF REDUCING SULPHUR DIOXIDE TO ELEMENTAL SULPHUR. *(Texas Gulp Sulphur Co.) U. S. Pat. 3,199,955. 16p., Aug. 10, 1965. 8 refs. (Appl. Aug. 20, 1962, 6 claims).*

A method of producing elemental sulfur from sulfur dioxide and SO2-containing gases from furnaces and other operations involving the combustion of sulfur bearing fuels, is discussed. The process involves reducing SO2 to elemental sulfur with a gaseous hydrocarbon in the presence of a catalyst. The catalyst may be activated alumina, bauxite, calcium sulfide, or quartz. The process takes place in three stages. In the first, elemental sulfur is produced together with a gaseous mixture of hydrogen sulfide, carbonyl sulfide, carbon disulfide, and SO2. During the reaction the temperature is maintained below 1000 C. In the second stage, the gases are cooled to 390 C and contacted with a catalyst. This causes the carbonyl sulfide and carbon disulfide to react with SO2, producing additional sulfur. By cooling to 125 C the free sulfur is condensed and separated, leaving hydrogen sulfide and SO2. In the third stage this gas heated in the presence of a catalyst to about 200 C in order to react the hydrogen sulfide and SO2 which produce additional elemental sulfur.

34377 **APTIC NO. 57103**

Zemskov, I. F.

CONTINUOUS REMOVAL OF SULFUR DIOXIDE FROM GAS MIXTURES BY A FLUIDIZED LAYER OF SOLID GRANULAR ABSORBENT. *Izv. Vysshikh Uchebn. Zavedenii, Khim. i. Khim. Tekhnol., 8(1):94-98, 1965. 12 refs. Translated from Russian, 7p.*

The adsorption of sulfur dioxide from gas mixtures by carbon followed by thermal regeneration and repeated saturation with C was investigated. A technological scheme of an installation was developed and a flowsheet for the continuous purification is presented. If activated C of type SKTD-1 is used as adsorbent, 5-6 tons C must be passed through the circulation system to adsorb 1 ton of SO2. In the process of adsorption 200,000 250,000 cu m gas will be purified by removal of SO2 at an initial content of approximately 0.2% SO2 in the gas. The gas velocity in the adsorber for C of the SKTD type with a grain size of 1.5-3 mm is assumed to be equal to 1.3-1.5 m/sec.

1964

34378 **APTIC NO. 57359**

Karwat, Ernst

REMOVAL OF NITRIC OXIDE FROM GAS MIXTURES CONTAINING THE SAME. *(Gesellschaft fuer Linde s Eismaschinen A. G., Hollriegelskreuth (West Germany)) U. S. Pat. 3,149,907. 1p., Sept. 22, 1964. 2 refs. (Appl. July 17, 1961, 3 claims).*

This invention provides a method of operation in which nitric oxide is removed completely and economically from mixed gases containing up to 50 ppm of NO gas, such as coke oven gas, generator gas, and flue gas. It is characterized by washing the NO-containing gas mixture with an aqueous solution of sodium chlorite, NaClO2. This solution is best applied when it has a pH value between 7 and 12. The gas mixture is washed in two separate wash towers filled with Raschig rings. If the gas mixture is to be liberated of NO for eventual extraction of carbon dioxide, it is washed with an aqueous acidified NaClO2 solution whose pH value is between 6 and 3.

34379 **APTIC NO. 57369**

Valdes, A. R.

NEW LOOK AT SULFUR PLANTS. PART 1. DESIGN. *Hydrocarbon Process. Petrol. Refiner, 43(3):104-108, March 1964.*

In the recovery of sulfur from sour gas, consideration should be given to combustion of acid gas, catalytic conversion stages, reheating, and tail-gas disposal. The Claus process is based on producing sulfur by burning hydrogen sulfide under controlled conditions to achieve a hydrogen sulfide/sulfur dioxide ratio of 2 to 1 in the products of combustion, and reacting these gases in the presence of a suitable catalyst to recover an additional amount of sulfur. The once-through design for the combustion of acid gases employing one catalytic bed is preferred over a bypass design. The bypass design with a single bed will result in a recovery of about 82%, and all of the sulfur is formed in one catalytic step. The once-through design includes two sulfur yielding steps one in the free flame of the combustion chamber and another in the catalyst chamber. The corresponding conversions are 60 and 65%, respectively. Performance guarantees of 90% or higher require two or more catalyst stages. The activity of the bottom half of a thick single bed will not be as active as two separate beds, each containing half the amount of catalyst in the larger bed. There are three methods of reheating the feed gas to the converter beds. In one method the cooled gas is raised to operating temperature by direct mixing with a hotter stream of gas. The second method consists of a direct fired, refractory lined reheater in which the products of combustion of a side stream of acid gas furnish the heat. The last method utilizes the exothermic reaction heat produced in the converters to reheat the gas by use of gas-to-gas exchanger. Incineration of tail gas is the accepted manner of handling this air pollutant. It is now believed that use of three catalyst beds may be a better solution.

1963

34380 **APTIC NO. 57280**

Zimmerley, S. R.

REVERBERATORY SMELTING METHOD AND APPARATUS. *(Kennecott Copper Corp.) U. S. Pat. 3,102,806. 5p., Sept. 3, 1963. 4 refs. (Appl. June 10, 1958, 5 claims).*

Both the roasting and smelting reactions of copper ores occurring on the exposed slopes of the banked charge are greatly enhanced if additional oxygen (as a pure gas or oxygen-enriched air) is blown onto such slopes after they have become hot and reactive from the customary reverberatory procedure. Increase in the relative proportion of oxygen to air produces a corrsponding increase in the reaction rates. Impingement of an oxygen-supplying fluid stream against the hot charge raises its temperature significantly, and smelting heat is evolved directly in the area where smelting is taking place, rather than being reflected from the roof. As a result, preliminary roasting of the ore material is unnecessary, and higher than usual temperatures are possible for smelting purposes, without endangering the furnace structure. Other advantages are increased melting rate control of matte grade, including the elimination of more sulfur and the slagging of more iron during smelting; less consumption of carbonaceous fuel in the burners; production of a smaller amount of gas and entrained dust for passing to waste or returning to the furnace; a versatile smelting operation whereby large variations in the composition of the feed can be accommodated by the degree of oxygen-enrichment of or the number of streams directed against the charge.

1962

34381 **APTIC NO. 57372**

Veal, Dean J.

REMOVAL OF NITRIC OXIDE FROM GAS STREAMS. *(Phillips Petroleum Co.) U. S. Pat. 3,050,363. 2p., Aug. 21, 1962. 8 refs. (Appl. July 28, 1958, 4 claim).*

A process for the removal of nitric oxide present in gas streams is described in which the nitric oxide is oxidized to nitrogen dioxide by oxygen which is also present in the gas stream. The nitrogen dioxide is then removed by contacting the gas stream at a temperature of 0 to 15 C with an adsorbing catalyst. The catalyst used is iodine pentoxide deposited on a porous support. The gas, which is now free of NO2, is separated from the catalyst.

34382 **APTIC NO. 57884**

Wallis, E.

THE RECOVERY OF SULPHUR IN A MARKETABLE FORM FROM FLUE GASES. *Brit. Chem. Eng., 7(11):833-836, Nov. 1962. 5 refs.*

The recovery of sulfur from flue gases by means of the Fulham-Simon-Carves process is described. With this process the flue gas is reacted directly with ammonia liquor from gas works, and the solution processed to give ammonium sulfate and sulfur. In the flue gas washing system SO2 is absorbed by ammonia resulting in the formation of sulfites. A continuous converter was designed to carry out the reactions which convert the sulfites to sulfates and elementary sulfur. In the converter, a mixture of liquor and sulfur flow to a settling pot where the sulfur separates from the liquor. The application of this process is limited by the availability of supplies of cheap liquor and the market for ammonium sulfate. This system was tested in a pilot plant.

1961

34383 **APTIC NO. 57637**

Allard, M., P. Vayssiere, an/ G. Namy

COLLECTING UNBURNT GASES FROM OXYGEN CONVERTERS. *J. Metals, 13(6):421-424, June 1961.*

In the refining of hot metal in top-blown oxygen converters, the gases are usually burned in the hood with a large excess of air and then cooled. Before releasing these gases to the atmosphere, it is necessary to remove the finely-divided iron oxide particles. To avoid the disadvantages of collecting and cleaning a considerable quantity of fume, the volume of gas to be treated should be reduced to a minimum. This can be accomplished by collecting the gas directly at the nose of the converter before combustion. A pilot plant test was run using this method. The plant was fitted with a collection hood consisting of a water jacket traversed by the oxygen lance and a gas-tight system for ore addition; a gas conduit at the end of which the gases may be led to either a dust-collecting system or directly to the atmosphere; and an automatic regulation system. Charges were about 6 tons, with the hot metal containing 1.8% phosphorus. Low-P hot metal with silicon content from 0.1 to 1.7% was also used. Oxygen was supplied at a rate between 10 and 20 normal cu m/min. Carbon monoxide content of the gases was usually between 60 and 70%. This method requires the treatment of only 1/8 of the volume of gas handled by conventional techniques, resulting in a large drop in the consumption of energy and a considerable reduction in the size and cost of the installation. These techniques present the advantage of lower cost both of investment and operation for the dust collecting installation as well as the possibility of recovering gas of considerable colorific value.

34384 **APTIC NO. 57248**

Chu, Chieh and O. A. Hougen

OPTIMUM DESIGN OF A CATALYTIC NITRIC OXIDE REACTOR. *Chem. Eng. Progr., 57(6):51-58, June 1961. 11 refs.*

Nitric oxide was oxidized to nitrogen dioxide using activated carbon as a catalyst in an experimental reactor. The design and cost of the process and the multiple bed parallel flow reactor were optimized from experimental reaction data using an IBM 650 computer. Major operating variables were optimized including type of catalyst, feed composition, dew point of entering gas, temperature of feed, temperature control, pressure, recirculation, pressure drop, conversion, mass velocity, catalyst size, number of catalyst layers, catalyst loading, depth of bed, diameter and height of reactor. The oxidation is the second step in the Wisconsin process of nitrogen fixation. The advantage of the optimum design is in the use of larger catalyst pellets which permit a reduction in pressure drop with corresponding savings in costs of steam, blower, and turbine. Reactor costs were cut by the use of a multiple-layer bed. The scheme is applicable to other chemical reactors processing large volumes of highly diluted reacting gas.

1960

34385 **APTIC NO. 57636**

Andersen, Holger C. and Duane R. Steele

THE PURIFICATION OF COKE OVEN GASES WITH PLATINUM METALS CATALYSTS. *Engelhard Ind. Tech. Bull., 1(3):106-108, Dec. 1960. 10 refs.*

A laboratory life test of over 3000 hr was performed on catalysts by passing a feed gas containing 59.8% hydrogen, 10% carbon monoxide, 28% methane, 2% ethylene and 0-400 ppm carbonyl sulfide, 30-70 ppm nitric oxide, and 2000 ppm acetylene over 4 cc each of supported palladium and ruthenium at the rate of 32 l/hr. No loss in catalytic activity was evidenced at 150 C during the test. At atmospheric pressure, NO was reduced to less than 0.3 ppm and C2H2 to less than 2.0 ppm. With 2000 ppm of oxygen added to the feed gas, C2H2 was reduced to 50 ppm and COS to 25 ppm. At a pressure of 14 to 14.7 atmospheres, and with 2000 ppm O2 in the feed, NO, C2H4, and COS were reduced to less than 0.02, 2.0, and the 25 ppm, respectively. A feed gas containing 60% H, 10% CO, and 30% N, and 1000 ppm butadiene, 500 ppm, C2H2, and 500 ppm C2H4 was passed at atmospheric pressure over supported Ru catalyst at the rate of 8000 l/hr/l of catalyst. At 225 C, the butadiene and C2H2 were reduced to less than 50 and 2 ppm, respectively.

34386 **APTIC NO. 57577**

Lugowska, Maria

ON THE POSSIBILITY OF OBTAINING SULFUR DIOXIDE FROM DOMESTIC SULFUR-CONTAINING ORES. I. *(O mosliwosci uzyskiwania dwutlenku siarki z krajowej rudy siarkonosnej, cz. 1). Text in Polish. Przemysl Chem., 40(2):95-98, 1960. 27 refs.*

Fluidization furnaces of the type used in Nevada are difficult to use on domestic ores, which contain calcium in the form of marl. Calcium will react with sulfur dioxide to form calcium sulfide and sulfate, but if the rate of combustion of the sulfur ores can be made rapid enough, these undesired reactions can be kept to a minimum. Experiments were conducted on gangue containing 93% calcium carbonate, obtained as a by-product of the milling of domestic sulfur-containing ores. The gangue was placed in an electric furnace, and subjected to various temperatures between 600 and 850 C, and to mixtures of air, nitrogen and sulfur dioxide, in which the last constituents varied from 7 to 12%; durations of exposure varied from 2 to 30 min. The presence of CaS and CaSO4 was determined. Results indicate that if the SO2 loss is to be kept within tolerable limits, the furnace temperature should not exceed approximately 600 C.

34387 **APTIC NO. 57639**

Reitmeier, Ronald E.

PROCESS OF REMOVING NITROGEN OXIDES FROM GAS STREAMS OF VARYING COMPOSITIONS. *(Chemetron Corp., Chicago, Ill.) U. S. Pat. 2,924,504. 3p., Feb. 9, 1960. 2 refs. (Appl. Aug. 30, 1956, 4 claims).*

A process of removing small amounts of nitrogen oxides from a nitric acid plant tail gas stream is discussed. Gas streams contaminated with small amounts of nitrogen oxides and subject to wide variations in composition may be purified by catalytic reduction. The tail gas stream is continuously mixed with a reducing gas which may be either hydrogen, carbon monoxide, or a hydrocarbon. The resulting gas stream is conducted through a fixed catalyst bed consisting of from 1 to 5% by weight of iron, cobalt, nickel, or copper supported on an inert refractory carrier. The temperature of the gas stream entering the bed is adjusted so that the temperature of the effluent gases is between 1500 and 1900 F. By using this process, the nitrogen oxides can be effectively reduced to elemental nitrogen. It is also desirable to add sufficient reducing gas to the tail gas so that the effluent stream from the catalyst bed contains between 0.2 and 5% total free hydrogen and carbon monoxide.

1959

34388 **APTIC NO. 57377**

Cronan, C. S.

WHERE TAIL GAS OXIDATION STANDS TODAY. *Chem. Eng., 66(1):66-68, Jan. 12, 1959. 1 ref.*

If made to work properly, catalytic reactors, which burn nitrogen dioxide in tail gases to colorless gases, may have far reaching implications for the design of nitric acid plants. These catalytic combustors can serve a dual purpose: elimination of air pollution caused by escaping nitrogen oxides and increased power recovery, achieved by either greater turbine efficiency or by generation of steam before gas passes through the turbine. When an inexpensive fuel gas, such as waste oxygen or natural gas, is injected into the tail gas stream containing about 0.05% nitrogen oxides and 2-4% oxygen, and the mixture passes over a suitable catalyst, two reactions take place: methane and oxygen form carbon dioxide and water; nitrogen dioxide and methane form carbon dioxide and nitrogen. Platinum, nickel, rhodium, and palladium are among the catalysts which promote these reactions. At the present time there are no standard combustors that meet all plant specifications. Cost of a combustor ranges from $1.50 3.00/scfm tail gas processed, depending upon the catalyst.

34389 **APTIC NO. 57587**

Rosenqvist, Terkel

PROCESS FOR THE PRODUCTION OF SULPHUR, METAL OXIDES AND METAL SULPHATES. *(Assignee not given.) U. S. Pat. 2,869,999. 4p., Jan. 20, 1959. 5 refs. (Appl. Feb. 25, 1957, 4 claims).*

A process is described for treating heavy metal sulfide ores to produce sulfur, metal oxides, and metal sulfates. An ore such as iron sulfide is roasted with air without sintering or melting. Part of the reaction heat is utilized for heating purposes and for pyrite distillation in the layers of charge at higher levels. A greater part of the reaction heat, however, is removed from the reaction furnace at or above the zone of roasting, by conducting a great part of the gas through a cooler (or steam boiler), and afterwards returning it to the reaction furnace at a place below that zone by means of a fan. In that way sintering or melting of the charge is avoided, and the heat liberated in the process can be utilized at convenience. The circulating gas consists mainly of nitrogen and sulfur dioxide. Sulfur dioxide formed by the roasting ore is reduced by carbon monoxide in coke oven gas, producer gas, or blast furnace gas, and the heat of reaction is used to distill off the sulfur formed.

34390 **APTIC NO. 57575**

Snowball, Arthur F.

CONTROL OF AIR POLLUTION AT COMINCO OPERATIONS. *J. Air Pollution Control Assoc., 9(1):54-58, May 1959.*

Cominco, The Consolidated Mining and Smelting Company of Canada Limited, produces 14,000 tons/month of sulfur dioxide stack gas. Commencing in 1928, Cominco built sulfuric acid plants to utilize the waste products. It was necessary to constantly measure all substances put into the atmosphere. A weather station is operated which measures temperature, humidity, pressure, and air movements. Bag filters are employed to catch dusts and chemical tests measure gases; Thomas SO2 recorders measure the SO2 gas. Particle-size determination plays an important role. Natural vegetation is an important tool of the smoke observer. A corrosion testing station also is operated, and bag filtering and increased metal recovery are used in control equipment. The Doyle scrubber is used in the recovery of solid particles, particularly those of small dimension, such as metallic oxides of particle size 2-5 micron. The scrubber comprises a jet formed by a conical obstruction in a round pipe. The annular jet permits the dust particles to be injected violently into a water bath by means of a high-pressure drop-induced draft fan. Weaker SO2 gases are scrubbed with a solution of ammonium bisulfite. Cominco has six sulfuric acid plants producing a total of 1300 tons of sulfuric acid per day.

34391 **APTIC NO. 57384**

Wendeborn, H. B., M. O. Peucker, and W. P. Massion

UPDRAFT SINTERING OF LEAD CONCENTRATES. *J. Metals, 11(11):748-751, Nov. 1959. (Presented at the American Institute of Mining, Metallurgical, and Petroleum Engineers, Annual Meeting, San Francisco, Calif., 1959.)*

The updraft technique is being used in Australia to produce sulfurous gases for acid production and in Germany to produce sinter for the roast-reaction lead-smelting process. The updraft method has the advantages of higher output, lower power consumption, and less wear on equipment. Also, by combining gas recirculation with updraft sintering, practically all of the roasted sulfur can be recovered in the acid-plant gas. With cold air blown through the sinter bed from bottom to top, the metallic lead is cooled and solidified on the spot where it is formed. Hence, it cannot drop through the bed into the lower zones or between the grate bars into the wind boxes. In updraft sintering it is possible to produce a sinter with a higher lead content, thus aiding the smelting of the sinter in the blast furnace. Especially important is the fact that this method permits the sintering of mixes containing 70% lead and above. Such high-lead mixes must be sintered in order to smelt lead in a short rotary furnace according to a recently developed Lurgi process which operates on the roast reaction.

1958

34392 **APTIC NO. 57598**

Bedjai, G., H. K. Orbach, and F. C. Riesenfeld

REACTION OF NITRIC OXIDE WITH ACTIVATED CARBON AND HYDROGEN. *Ind. Eng. Chem., 50(8):1165-1168, Aug. 1958. 14 refs. (Presented at the American Chemical Society, Annual Meeting, 132nd, New York, Sept. 1957.)*

Concentrations of nitric oxide of the order of 5000 ppm may be quantitatively removed from an inert gas or stack gas by reaction with activated carbon at 700 C and a space velocity of 1500 hr, and with hydrogen on a carbon catalyst at about 600 C and a space velocity of 1500 hr. The exact temperature at which hydrogen will react quantitatively with nitric oxide is dependent on the hydrogen-nitric oxide ratio and the surface area of the carbon. The activity of a given carbon decreases with time, eventually stabilizing, probably through formation of a layer of carbon oxygen complex on the surface of the carbon. The use of hydrogen greatly decreases the consumption of carbon. The beneficial effect of hydrogen is thought to be due to its reaction with the carbon-oxygen surface complex. Evidence of nitrous oxide in the reaction products at low temperatures indicates a more complex mechanism than heretofore assumed. The reactions have value in reducing nitric oxide on a commercial scale in certain industrial installations.

34393 **APTIC NO. 57157**

Fraser, James M. and Farrington Daniels

THE HETEROGENEOUS DECOMPOSITION OF NITRIC OXIDE WITH OXIDE CATALYSTS. *J. Phys. Chem., vol. 62:215-220, Feb. 1958. 10 refs.*

A study was conducted to determine quantitatively the catalytic effect of various metal oxides on the decomposition of nitric oxide. The compound is very stable at room temperature and its decomposition is of interest in the possible reduction of the concentration of nitrogen oxides in the exhaust fumes of automobiles and flames. Decomposition of nitric oxide was measured from 740 to 1040 deg by slowly passing the gas, diluted with nine volume of helium, over uniform pellets of several catalysts including aluminum, calcium, chromium, zirconium, iron, and zinc oxides. The extent of the decomposition, which was kept below 50%, was determined from the concentration NO2 formed subsequent to decomposition, as measured with a spectrophotometer. All reactions followed zero-order kinetics. The Arrhenius activation energies for the catalytic decomposition ranged from 16 to 39 kcal/mole. An interpretation of the results was made in terms of activation energy and surface areas, as determined for each catalyst by the Brunauer, Emmett, and Teller theory, using low-temperature nitrogen absorption. The best catalysts for the decomposition of nitric oxide seemed to be CaO, Al203, and Ga2O3. At the low concentration of nitric oxides less than (0.1%) found in the exhaust gases of automobiles and power plants, the reaction would probably not be zero-order. The low activation energy noted on iron oxide indicates that a specially prepared iron oxide might show promise at lower temperatures.

3439 **APTIC NO. 57633**

Jacobs, J. K. and J. D. Mirkus

COAL DESULFURIZATION II A FLUIDIZED CARBONIZER. *Ind. Eng. Chem., 50(1):24-26, Jan. 1958. 11 refs. (Presented at the American Chemical Society, 131st Meeting, Miami, Fla., April 1957.)*

An experimental program was undertaken to provide insight into the effect of process variables on the fluid bed desulfurization of a commercial coal. All experiments were run in bench-scale equipment using an agglomerating high sulfur bituminous coal with an S content of 4.9%. Desulfurization varied inversely with feed particle size. Study of the effect of residence time on desulfurization showed that the process probably took place in two phases. In the devolatilization phase, the sulfur content dropped rapidly to around 60% in about 8 min. The second phase was a chemical reaction in which the sulfur content fell off slowly and steadily. Desulfurization was not very sensitive to air content. Above 60%, air could not be run without excessive combustion of the material, and below 5% the coal fused because of insufficient preoxidation. Sulfur removal increased with increasing temperature up to 800 F. Results of the tests show that major evolution of organic matter occurs in the range of 750 to 850 F. Preliminary survey runs indicated that the following are reasonable operating conditions consistent with good pilot-plant operation: residence time, 18 min; temperature, 950 F; fluidizing velocity, 0.85 ft/sec; and, particle size, 1/16 in. hammer mill grind. Desulfurization is sensitive to the form and particle size of sulfur, but not to steam or air content of the gases. It improves with residence time, temperature increase up to 800 F, and superficial fluidizing gas velocities above 0.75 ft/sec.

34395 **APTIC NO. 57557**

Streight, H. R. L.

REDUCTION OF OXIDES OF NITROGEN IN VENT GASES. *Can. J. Chem. Eng., 36(1):3-11, Feb. 1958. 23 refs. (Presented at the Chemical Institute of Canada, Annual Conference, 4th, Vancouver, B. C., June 3-5, 1957.)*

Because nitrogen oxides act as catalysts and oxidize organic materials in the presence of ultraviolet light or bright sunlight, an extensive pollution abatement program was undertaken by an organic chemical plant located in a recreational and agriculture area. The problem was to reduce the nitrogen dioxide and nitric oxide emitted by stack gases sufficiently that after their dispersion their maximum ground concentration would be less than the safe threshold limits accepted for individuals and vegetation. Pilot plant tests confirmed literature search findings that nitrogen oxides could effectively be absorbed into sodium carbonate or hydroxide solutions. A fume absorption system was designed to reduce in a single absorber, with ancillary equipment, nitrogen oxides coming from three sources: off-gases from the nitric acid plant, reaction off-gases, and vent gases from tanks and process equipment. Later tests showed that ammonia-caustic liquor was more effective than a dilute scrubbing solution in eliminating the color of the effluent gases and also indicated the effectiveness of a venturi scrubber, since installed, in removing fine ammonium solids. Plant performance data shows that removal of ammonium nitrate, nitrite solids, and nitrogen oxides ranges from 50 to 80%.

1957

34396 **APTIC NO. 57374**

Tarbutton, Grady, J. C. Driskell, T. M. Jones, F. J. Gray, and C. M. Smith

RECOVERY OF SULFUR DIOXIDE FROM FLUE GASES. *Ind. Eng. Chem., 49(3):392-395, March 1957. 28 refs. (Presented at the American Chemical Society, 130th Meeting, Atlantic City, N. J., Sept. 1956.)*

Four processes for recovering sulfur dioxide in useful form from coal combustion gases were investigated on a small scale. The gases used were a synthetic mixture, containing 0.35% SO2. The composition corresponded to gas produced by the combustion of coal containing 3.5% sulfur in a 10% excess of air. In the direct sulfuric acid process, manganese oxide was used to catalyze oxidation. Maximum acid concentration was 40%. Less than 0.1% phenol vapor in the simulated flue gas almost completely prevented recovery of SO2. Until problems of catalyst contamination can be solved, this process is economically infeasible. In the direct phosphatic fertilzer process, SO2 was absorbed by a slurry of rock phosphate. With a retention time of 32 sec, 50% absorption was obtained. Results show that the method is not feasible. The direct ammonium sulfate process used manganese oxide to catalyze oxidation. The 75 to 100% SO2 recovery as the sulfate with retention times of 18 to 36 sec, and 64% for 8.4 sec, shows that this process could be applied commercially. The regenerated manganese dioxide process uses a slurry of regenerated MnO2 to absorb and oxidize the SO2. Absorption of the gas was 90%. Decomposition of the resulting manganese sulfate by heating with 5 to 10% C to about 900 C in a gas that is low in oxygen produces 100% decomposition of the SO4; 99% of the evolved S is in the form of the dioxide. From the results of the studies, this process is also economically feasible.

1956

34397 **APTIC NO. 57277**

James, Ivor J. Jr., and Art C. McKinnis

CHEMICAL OXIDATION PROCESS IN THE ADSORBED PHASE. *(Union Oil Co. of Calif.) U. S. Pat. 2,756,127. 8p. July 24, 1956. 13 refs. (Appl. June 30, 1952, 21 claims).*

This invention relates to a process for the chemical conversion of gaseous reactants in the presence of an adsorbent and particularly pressure enhanced oxidation reactions. The process is characterized by the fact that the chemical reaction between the gaseous reactants takes place in the adsorbed phase under unusually high pressure existing on the adsorbent while the system pressure as measured by gauges may be at or near atmospheric. The adsorbent may or may not contain catalytic materials. The essential elements of the process in the oxidation embodiment of this invention comprise the adsorption of the less readily adsorbable reactant on the adsorbent, such as charcoal, the subsequent reaction of this less readily adsorbed reactant by contacting the adsorbent with the more readily adsorbable reactant, the stripping of the preferentially adsorbed product from the carbon catalyst with steam and/or indirect heating, and the separation of the reaction product from the mixture desorbed from the adsorbent.

1955

34398 **APTIC NO. 57169**

Chapman, W. R. and D. C. Rhys Jones

THE REMOVAL OF SULPHUR FROM COAL. *J. Inst. Fuel, 28(170):102-108, March 1955. 15 refs. (Presented at Opening Conference of Special Study of Sulphur Removal and Recovery from Fuels, London, Oct. 6, 1954.)*

The distribution of the sulfur-containing ingredients of raw coal cannot be removed by present methods of coal preparation based on differences in appearance, in density, or in surface properties. Organic sulfur is intimately associated with the coal substance. It most probably exists as part of the molecular structure of coal and not in the form of less complex separate organo-sulfur compounds. It is fairly uniformly distributed through the coal and its presence does not impart any characteristic physical quality to the coal. The problem of removing sulfur therefore reduces to the elimination of pyrites present either as discrete particles or as particles in association with coal in sufficient quantities to change its physical properties. Grinding and froth flotation are not adequate for the extraction of pyrites in the quantities desired. Possible new avenues of approach include oxidation and subsequent leaching of the coal in water to partially remove pyritic sulfur. It is also possible that selective oxidation of the sulfides could be affected by treatment with a suitable catalyst or bacteria.

34399 **APTIC NO. 57358**

Lawler, W. Clayton

USE OF A SULFUR DIOXIDE SCRUBBING SYSTEM IN AIR-POLLUTION CONTROL. *In: Problems and Control of Air Pollution. F. S. Mallette (ed.), New York, Reinhold, 1955, p. 222-224. (Presented at the American Society of Mechanical Engineers, First International Congress on Air Pollution, New York, March 1-2, 1955.)*

A system for the recovery of sulfur dioxide from sulfuric acid plants involves the use of a redwood scrubbing tower and a stripper for recovering the SO2 from an ammonium sulfite-bisulfite solution. Absorbing solution is circulated in the top section of the tower to remove all but traces of the SO2. Exit gases from the acid plant containing SO2, which formerly was discharged to the atmosphere, now enter the base of the tower through a vestibule. The system is so designed that a minimum of ammonium sulfate is formed and a maximum of SO2 is removed from the gas stream. Solution is continuously bled from the scrubber to the stripper. The exit gases from the stripper containing SO2 and air are returned to the acid plant drying tower for conversion to sulfuric acid. By using this system, it is possible to reduce the SO2 concentration in exit gases to less than 0.03%.

34400 **APTIC NO. 57376**

Peters, Max S.

STOP POLLUTION BY NITROGEN OXIDES. *Chem. Eng., 62(5):197-200, May 1955. 8 refs.*

With water as the absorbing medium and air as the diluent, the removal of nitrogen oxides was investigated by two processes: absorption combined with chemical reaction, during which nitrogen dioxide and nitrogen tetroxide react with water to form nitric acid, and adsorption. Absorption equipment used comprised packed towers, spray towers, a bubble-cap tower, and a fritted bubbler. Silica gel was used for adsorption. Efficiency results for absorption equipment and the silica gel adsorber were plotted and tabulated. The best removal efficiency was obtained from the fritted bubbler, although the bubble-cap tower also worked well at low gaseous oxide concentrations. Silica gel gave the best removal efficiency at gaseous concentrations less than 0.4% nitrogen oxides, and is recommended if essentially complete removal of oxides is indicated. Mechanical factors, such as cycle change and desorption requirements make the process more complicated than a continuous absorption process. The optimum type of absorption equipment should combine the best features of both the bubble-cap tower and the fritted bubbler. Removal efficiency of both units was independent of the liquid rate as long as the liquid concentration did not increase above 10 wt% nitric acid, and the gas-liquid contact time was not sufficient for any appreciable oxidation of the nitric oxide formed in the chemical reaction.

34401 **APTIC NO. 57639**

CONTROLLING MECHANISM IN THE AQUEOUS ABSORPTION OF NITROGEN OXIDES. *Am. Inst. Chem. Engrs. J., 1(1):105-111, March 1955. 10 refs.*

The removal of nitrogen oxides from gaseous mixtures is important in the production of nitric acid and in the cleaning of certain stack gases. The removal may be accomplished by the reaction of nitrogen dioxide or nitrogen tetroxide with water to form nitric acid and nitric oxide. The factor which controls the overall mechanism in the removal is the rate of the chemical reactions involved. The rate of removal is proportional to the concentration of N2O4 in the gases. Because the fraction of total oxides present as N2O4 is low when the concentration of gaseous oxides is low, the individual plate efficiencies for removal of nitrogen oxides from dilute gases are poor. Improved plate efficiencies can result with high total pressure. The chemical reactions between nitrogen oxide and water occur partially in the gas phase, as seen by the formation of a mist when NO2 and N2O4 are in vapor. The fraction of the entering oxides which are converted to nitric acid decreases as the contact time between the gas and liquid decreases. If experimental data for the equipment are available for one gas rate, the integrated kinetic equations can be used as an estimation of the effect of change in gas liquid contact time. An understanding of the controlling factors in this process should indicate methods for improving the design of absorption towers in nitric acid plants and aid in the design of scrubbers for removing nitrogen oxides from waste gases.

1954

34402 **APTIC NO. 57278**

Herneryd, O., O. A. Sundstrom, and Allan Nono

COPPER SMELTING IN BOLIDEN S RONNSKAR WORKS DESCRIBED. *J. Metals, 6(3):330-332, March 1954.*

The material from the Boliden mines consists of three different types of concentrates: copper concentrates with 25 to 27% copper and more than 30% sulfur and 0.5 to 2.0% arsenic; copper concentrates with 25 to 27% copper, with 30% sulfur and 2 to 6% arsenic; and concentrates with less than 1% copper but rich in gold and with 20 to 25% sulfur and more than 10% arsenic. Because of the high arsenic content in some of the material, special precautions have been taken to bring down the amount of gas and dust in the roaster building. For this purpose each roaster is supplied with a hood on top and a drum on the furnace wall opposite each row of doors gathers gas and dust. The roaster gases are conducted by cyclones where large amounts of metal-containing dusts are separated and returned to the furnace. They then go to a gas purifying plant. The material containing the highest degree of arsenic is roasted in special furnaces and with other compounds, and the resulting arsenic oxide is precipitated in the gas cleaning plant and collected as crude arsenic. In the electric furnace, six gas exhausts join together in one flue. Dust accumulated in the flue can be continuously returned to the furnace by a chain conveyor. The flue is connected with a Cottrell filter where the last traces of dust conveyed by gases are recovered.

34403 **APTIC NO. 57187**

Lowenstein, Walter G.

AN IMPROVED METHOD OF RECOVERING SULPHUR VALUES FROM FLUE GASES. *(Standard Oil Development Co.) Brit. Pat. 708,095. 7p., April 28, 1954. (Appl. Feb. 21, 1952, 6 claims).*

A method of removing sulfur dioxide from waste gases in order to recover the sulfur in some usable form is described. Sulfur dioxide can be substantially removed from flue gases by scrubbing the gases with a slurry of magnesium hydroxide to absorb SO2, and convert part of the hydroxide to sulfite. The mixture of unconverted hydroxide and sulfite is withdrawn to a first oxidation zone where it is blown with an oxygen-containing gas to oxidize magnesium sulfite to sulfate. This solution is passed to a second zone where it is contacted with ammonia to form ammonium sulfate and to precipitate magnesium hydroxide. The precipitated magnesium hydroxide is separated from the solution and pumped back to the scrubbing tower and the ammonium sulfate is recovered.

1953

34404 **APTIC NO. 57640**

Lee, A. E. Jr.

SINTERING ZINC CONCENTRATES ON THE BLACKWELL 12 BY 168 FT MACHINE. *J. Metals, 5(12):1631-1633, Dec. 1953. 3 refs. (Presented at the American Institute of Mining Metallurgical, and Petroleum Engineers, Los Angeles, Calif., Feb. 1953, Paper TP 3668D.)*

One-step sintering of zinc concentrates is discussed. The sinter machine size is 12 by 168 feet for a rated capacity of 540 tons/day. Better lead and cadmium elimination in sintering permitted the furnace production of slab zinc lower in lead and cadmium. The 30 to 31% sulfur content of the -200 mesh zinc concentrates is the fuel used to sinter the charge. Sufficient sulfur must be used to obtain fritting of the charge and to aid in the elimination of lead and cadmium. Concentrates and return sinter fines are stored in 16 circular steel bins. Eight of the bins receive concentrates by overhead conveyer from the ore unloading and storage area. The remaining eight bins return sinter from the discharge unit of the sinter machine. Material removed in the windboxes and cyclones from the sinter machine exit gas system is continuously collected by a belt conveyer system and delivered to a small surge bin. Gases from the collector main balloon flues servicing the six windboxes nearest the discharge end of the sinter machine pass through cyclones to a pair of draft fans. They are then piped to a baghouse for lead-cadmium fume collection. Gases from the collector main balloon flues servicing the 10 windboxes at the feed end of the machine pass through other cyclones to a second pair of fans. They are piped either to the baghouse or to a recirculation hood. The purpose of the recirculation system is to reduce by half the gas volumes filtered by the baghouse. Since most of the lead and cadmium eliminated leaves the bed near the discharge end, the gases recirculating contain little fume.

34405 **APTIC NO. 57617**

Moore, Ray H.

PRACTICAL CONTROL METHODS OF FOUNDRY AIR POLLUTION. *American Foundrymen s Society, Des Plaines, Ill. and Illinois Univ., Urbana, Ill., Dept. of Mechanical Engineering, Symp. Foundry Saf., Health, Air Pollut., Urbana, Ill., 1953, p. 99-106. (Feb. 17-19.)*

There are two basic practical control methods of foundry air pollution. One is ventilation, in which fumes and steam are captured by exhaust hoods and discharged outdoors where they are allowed to dissipate by diffusion in the atmosphere. The other is dust collection, in which the capture method is substantially the same but the particulate matter is arrested from the dust-laden air before it is discharged to the atmosphere. Whether the pollutant be fume or dust, the carrying medium by which capture and exhaust is accomplished is air, and the quantity of air required depends on the character of the work station and the exhaust hood construction. By pictures and diagrams, several basic principles of air exhaust application and hood construction are described, and their functions as applied to practical air pollution control are explained.

34406 **APTIC NO. 57394**

Pike, Robert D.

NITRIC OXIDE RECOVERY SYSTEM. *(Assignee not given.) U. S. Pat. 2,647,822. 5p., Aug. 4, 1953. 19 refs. (Appl. April 13, 1948, 7 claims).*

A method of recovering nitric oxide from furnace gases is discussed. In this process, the nitric oxide-containing gases are cooled to temperatures below 32 F, and passed through silica gel to catalytically oxidized the nitric oxide to nitrogen dioxide. The gas is then removed from the silica gel and cooled further to condense the NO2 which can then be recovered. The remaining gases are again passed through the silica gel to recover additional NO2. After all the NO and NO2 has been removed from the gases, they are recirculated for heat exchange to cool the warm furnace exit gas.

1952

34407 **APTIC NO. 57379**

Rao, M. N. and O. A. Hougen

CATALYTIC OXIDATION OF NITRIC OXIDE ON ACTIVATED CARBON. *Chem. Eng. Progr., Symp. Ser., 48(4):110-124, 1952. 26 refs.*

The homogeneous oxidation of nitric oxide to nitrogen dioxide in the gaseous phase was slow, especially at low concentrations (1 to 3%). The possibility of using activated carbon as a catalyst was investigated by means of a series-type flow reactor. A rate equation to represent the plausible mechanism of this catalytic oxidation is offered. The catalytic reaction using activated carbon follows the same apparent mechanism as that using silica gel as the catalyst. This mechanism consists of the formation of the nitric oxide complex (NO)2 equilibrium adsorption of the complex on single sites of the catalyst, surface reaction between the oxygen in the gas phase and the adsorbed complex, and finally desorption of the nitrogen dioxide. The surface reaction is the rate-controlling step. The constants of the corresponding rate equation gave good agreement with experimental data and with thermodynamic principles. From the rate equation the effects of temperature, total pressure, feed compositon, and percent conversion on the rate of reaction were graphically presented. A comparison of the homogeneous reaction with the catalytic reaction using silica gel and activated carbon as catalysts was made in terms of reaction rates and reactor volumes.

1951

34408 **APTIC NO. 57366**

James, Ivor J.

PROCESS FOR PRODUCING AND SEPARATING NITROGEN OXIDES. *(Union Oil Co. of Calif.) U. S. Pat. 2,568,396. 7p., Sept. 18, 1951. 13 refs. (Appl. July 19, 1946, 2 claims).*

The object of the invention is to provide an improved process for the production, recovery and purification of nitrogen dioxide and its dimer, nitrogen tetroxide. Another object is to provide a process for the separation of nitrous oxide from nitric oxide, nitrogen, and oxygen, as well as from nitrogen dioxide and its dimer. In general, the process of separating gaseous mixtures by selective adsorption on granular charcoal involves the steps of countercurrently adsorbing certain components of the gaseous mixture in a charcoal bed that may be either stationary or moving. In a moving-bed operation, the charcoal on which some of the gaseous components have been adsorbed flows from an adsorption zone through one or more rectification zones and into a stripping section, where the adsorbed components are desorbed from the charcoal by means of heat, with the aid of a stripping gas such as steam. The same series of operations would be performed in a stationary bed.

1950

34409 **APTIC NO. 57363**

Fleming, Edward P. and T. Cleon Fitt

HIGH PURITY SULFUR FROM SMELTER GASES - REDUCTION WITH NATURAL GAS. *Ind. Eng. Chem., 42(11):2249-2253, Nov. 1950. 7 refs.*

To curtail the amount of sulfur dioxide discharged into the atmosphere from copper smelting operations, a method of reducing it to elemental sulfur was employed. Pure SO2 gas was directly reduced to high-grade sulfur by reduction with natural gas. Several side reactions took place due to the high initial temperature employed. The chief-side-reaction products were to elemental sulfur efficiently, two conversion stages were necessary. The first step combines the carbonyl sulfide with residual SO2 to form carbon dioxide and sulfur vapor; the sulfur vapor is condensed to liquid sulfur in a Cottrell precipitator. The second stage combines hydrogen sulfide and SO2 to form water and elemental sulfur.

1949

34410 **APTIC NO. 57393**

Reid, W. S.

CONCENTRATION OF THE SO2 CONTENT OF DWIGHT-LLOYD SINTERING MACHINE GAS BY RECIRCULATION. *J. Metals, 1(4):261-266, April 1949. (Presented at the American Institute of Mining, Metallurgical and Petroleum Engineers, San Francisco, Calif., Feb. 1949, Paper TP 2554D.)*

Recirculation of the gases from Dwight-Lloyd sintering machines operating on a lead charge accomplished both the concentration of the sulfur dioxide content and a reduction in volume of the total gas produced. In one trial plant, with a 42-inch by 22-foot machine, introduction of the recirculating system reduced the gas volume from 19,000 to 6850 cfm and increased the SO2 concentration from 1.7 to 5.1%. A second installation, with a 42-inch by 30-foot machine, showed a gas reduction from 23,100 to 15,000 cfm, with an SO2 content of 4.5%. These gases are fed either to a sulfuric acid or an SO2 liquifaction plant. The SO2 plant is a patented process developed by the American Smelting and Refining Co. It functions through the absorption of SO2 in dimethylaniline flowing countercurrent to the gas stream in a tower consisting of a series of bubble-cap trays. The pregnant D.M.A. solution then goes to a stripping tower where the SO2 is expelled by boiling with steam heated calandrias. The wet SO2 is dried by passing through H2SO4 in a third bubble-cap tower. It is then compressed to liquid form and transferred to storage tanks from which the entire production is shipped in railroad cars. The system is not dependent on SO2 content of the gas and operates efficiently on the 5 to 6% SO2 in the gases normally produced by the recirculation units on the Dwight-Lloyd machines.

1948

34411 **APTIC NO. 57579**

Siller, C. W.

CARBON DISULFIDE FROM SULFUR DIOXIDE AND ANTHRACITE. *Ind. Eng. Chem., 40(7):1227-1233, July 1948. 15 refs. (Presented at the American Chemical Society, Annual Meeting, 113th, Chicago, Ill., 1947.)*

A process is described by which carbon disulfide can be prepared in good yields from sulfur dioxide and a relatively inexpensive source of C, such as anthracite coal. The reaction takes place in steps, each of which can be carried out at the temperature that gives maximum efficiency. The type of C used in the process is important. Very little carbon disulfide was formed when metallurgical coke was substituted for the anthracite coal. The coal had a greater initial reactivity and was continually activated by the chemical reactions that took place. Results of the experiments showed that several of the reactions took place at high rates. The slowest step in the process seemed to be the dissociation of carbonyl sulfide. The rate of this reaction depended on the rate at which the energy necessary for dissociation could be supplied. The efficiency of a furnace for making carbon disulfide will depend chiefly on the length and temperature of the middle hot zone and the thermal conductivity of the construction materials. The SO2 used can be a by-product of the roasting of sulfuric ores.

1945

34412 **APTIC NO. 57552**

Walthall, J. H., Philip Miller, and M. M. Striplin, Jr.

DEVELOPMENT OF A SULFURIC ACID PROCESS FOR PRODUCTION OF ALUMINA FROM CLAY. *Am. Inst. Chem. Engrs. Trans., vol. 41:55, 110-123, 1945. (Presented at the American Institute of Chemical Engineers Meeting, St. Louis, Mo., Nov. 19-21, 1944.)*

A method is described for the production of alumina from clay as developed through laboratory, small scale, and pilot plant scale. Production of alumina suitable for reduction to aluminum was technically feasible. Aluminum sulfate solution is formed by treatment of calcined clay with sulfuric acid. Iron impurities are removed from solution by treatment with manganese sulfate and ozone, or by electrolysis. The solution is partially concentrated, and silica is removed by treatment with clay residue, after which the solution is evaporated to dryness. Sulfur trioxide is hydrated and recovered as acid by electrostatic precipitation; sulfur dioxide is absorbed in weak sulfuric acid and catalytically oxidized to the acid. Impurities in the alumina are removed by leaching. Recommendations are made concerning construction of a commercial size plant.

1940

34413 **APTIC NO. 57590**

Lepsoe, Robert

CHEMISTRY OF SULFUR DIOXIDE REDUCTION. *Ind. Eng. Chem., 32(7):910-918, July 1940. 10 refs.*

The reduction of sulfur dioxide by carbon is expressed satisfactorily by two consecutive equations: (1) SO2 + C equals carbon dioxide + half sulfur, and (2) CO2 + C equals 2 carbon monoxide. The rate of formation of carbon dioxide between 900 and 1200 C, expressed as moles in the reaction products, is given by an equation which shows the ratio of the apparent reaction constants for SO2 and CO to be 10 to 1. Since the rate of SO2 reduction is only five times that of CO2 in the producer gas reaction, it is inferred that a third reaction, SO2 + 2CO equals 2CO2 + 1/2S2, also takes place as a reaction of the first order at the surface of the coke with ash as a catalyst. Above 1200 C, the rate of SO2 reduction appears to be controlled by gas diffusion rates. The reduction of SO2 by means of CO or oxysulfide is fast with any kind of catalyzing surface above 800 C. Alumina in the slightly hydrated and acid-soluble form is an efficient catalyst between 250 and 500 C, and the reaction appears to be of the first order. The reduction of SO2 by C can be used to recover sulfur from waste gases.

1938

34414 **APTIC NO. 57634**

Griffith, Roland H. and Samuel G. Hill

THE HYDROGENATION OF SIMPLE SULPHUR COMPOUNDS. PART I. NICKEL SUBSULPHIDE AS A CATALYST. *J. Chem. Soc., 1938:717-720. 8 refs.*

Nickel subsulfide (Ni3S2) was prepared from metallic nickel by way of the reduction of nickel sulfide in hydrogen at 300 deg for 3 hr. The subsulfide is a catalyst for the hydrogenation of simple sulfur compounds such as carbon disulfide, carbonyl sulfide, methylthiol, and sulfur dioxide present in small amounts in purified coal gas. The adsorption of the sulfur compounds on nickel subsulfide was measured at temperatures up to 350 deg. Carbon disulfide was adsorbed extensively and reversibly on nickel sulfide; it also was adsorbed extensively on nickel subsulfide, but a slower reaction took place in the temperature range explored (200 to 300 deg). Sulfur dioxide showed activated adsorption on nickel sulfide above 300 deg; on the subsulfide, activated adsorption began about 200 deg, but the results were complicated by slow decomposition of the solid, and the reaction was only partly reversible. Activated adsorption of methylthiol on the subsulfide began above 200 deg but in small amounts compared with that on carbon disulfide. There was no activated adsorption of carbon oxysulfide. Activated adsorption of hydrogen began between 100 and 200 deg.

34415 **APTIC NO. 57389**

Lessing, R.

THE DEVELOPMENT OF A PROCESS OF FLUE GAS WASHING WITHOUT EFFLUENT. *J. Soc. Chem. Ind., 1938:378-388, Nov. 1938. 21 refs.*

The condition attached to the consent for the erection of Fulham Power Station that sulfur, smoke, and grit should not be emitted from the chimneys called for experimental work to evolve a practical process which would also avoid pollution of the nearby Thames. Full-scale trials proved that almost complete elimination of sulfur dioxide was possible by washing the flue gas with a lime or chalk suspension, but demonstrated the risk of blockage by calcium sulfate. The mechanism of scale formation was due to supersaturation of the washing solution and uncontrolled crystallization of calcium sulfate dihydrate. Rapid de-supersaturation could be brought about by solid calcium sulfate dihydrate in suspension. The rate of de-supersaturation was a function of the amount of calcium sulfate dihydrate present in suspension. Scale formation could be prevented by adequate concentration of this compound for a definite time before permitting further absorption of sulfur oxides. Calcium sulfite inhibited the calcium sulfate dihydrate as a de-supersaturating agent. The conditions for rapid oxidation of calcium sulfite were studied. The results of the investigation were confirmed by extensive runs on the Fulham experimental plant and subsequently on a pilot plant. They formed the basis for the design of the large flue gas washing plant incorporated in the Power Station of the Metropolitan Borough of Fulham.

34416 **APTIC NO. 57601**

Roberson, A. H. and G. W. Marks

FIXATION OF SULFUR FROM SMELTER SMOKE. *Bureau of Mines, Metallurgical Div., RI3415, Oct. 1938. 35 refs.*

One method of sulfur dioxide removal from smelter smoke involves dissolving the gas in a suitable solvent and liberating it in concentrated form. Some of the aliphatic amines are suitable absorbents for SO2. All amines used in the investigation were of commercial grade. Stock solutions were made up by volume from material of ordinary grade. These were standardized by titration with standard sulfuric acid, methyl orange being used as the indicator. Recovery of SO2 after it has been absorbed in an amine solution depends largely on the partial pressure of the gas over the absorbing medium. Partial pressure studies that covered all temperatures and concentrations likely to be encountered were made. Solutions for partial pressure measurements were prepared by adding measured volumes of a given solution of definite amine content to measured volumes of the same solution saturated with SO2. Aqueous amine solutions saturated with SO2 were also prepared. Relative viscosities, densities, and volume changes before and after SO2 absorption were measured. The capacity of a given amine solution was determined by Dalton s law of partial pressures. From these studies, it is concluded that monoethanol amine, diethylene triamine, and triethylene tetramine are the most promising of all the amines studied.

1937

34417 **APTIC NO. 57566**

Dean, R. S., H. W. St. Clair, G. W. Marks, P. M. Ambrose, and F. S. Wartman

FIXATION OF SULPHUR FROM SMELTER SMOKE. *Bureau of Mines, Metallurgical Div., R. I. 3339, 51p., May 1937. 26 refs.*

The problem of removing sulfur dioxide from smelter smoke has been met in two ways including dilution with air currents and conversion to a liquid or solid sulfur compound. Control of dilution has been used most extensively due to its practicality for gases containing less than 2% SO2. This method is affected by wind conditions and air currents. Gases which contain enough SO2 to justify conversion have not been treated successfully by one-step processes; however, two-step processes which include a preliminary concentration have been satisfactory. Three such concentration processes proven on pilot plant scale include the Chemical Industries Process, the Lurgi Process (Sulphidine process), and the Guggenheim Process, which respectively use as absorbents basic aluminum sulfate solution, xylidine and sodium carbonate solution, and ammonium sulfite-bisulfite solution. All three processes require cooling of the stack gases. The formation of sulfate is a major problem in each of the processes. It is removed as sodium sulfate in the Lurgi Process and as calcium sulfate in the other two. Several reduction processes are also described. The reduction step presents fewer problems than the concentration step. The vapor pressure and thermodynamic properties of ammonium sulfites were investigated. Results showed that the use of ammonia in dust settling and sulfur recovery is practical only at fairly low temperatures. Loss of ammonium sulfites is quite great in any process which introduces ammonia gas into smelter smoke when the temperature of the settling chamber is above 50 C. The SO2 absorption capacity of diethylene triamine and other amines at various temperatures and a discussion of the oxidation of ammonium sulfite solution were also presented.

34418 **APTIC NO. 57155**

Lepsoe, Robert and James Roland Mills

METHOD FOR THE PRODUCTION OF A CATALYST FOR THE REDUCTION OF SULPHUR DIOXIDE. *(Consolidated Mining and Smelting Co. of Canada, Ltd.) U. S. Pat. 2,080,359. 3p., May 11, 1937. (Appl. Feb. 23, 1935, 12 claims).*

The invention describes an improved catalyst for the reduction of sulfur dioxide to elemental sulfur with special emphasis on the reaction of SO2 with incandescent carbon to produce carbon dioxide and sulfur. By sintering a mixture containing aluminum hydrate or other aluminum compounds at a low temperature made possible by the addition of a binding and sintering agent such as sodium silicate, the surface area is greatly increased. The catalyst retains part of the water of hydration; it is highly porous and has a surface area greater than any previously exposed; and it is able to withstand high reaction temperatures and corrosive gases. A mixture of finely ground aluminum hydrate is compounded at 1200 C in a carbonaceous fuel bed into which SO2 is introduced to form a gas mixture containing carbon monoxide and sulfur. In the upper part of the fuel bed the temperature is permitted to drop, either through heat exchange with incoming fresh fuel or other means, to 700-1000 C, during which the sulfur vapor combines with carbon monoxide to form carbonyl sulfide. Still higher in the furnace, or in a chamber outside the furnace, the gas is further cooled and the reaction continues. The addition of clean SO2 converts COS to sulfur and CO2. Substantially pure sulfur is condensed.

1936

34419 **APTIC NO. 57603**

Nonhebel, G.

A COMMERCIAL PLANT FOR REMOVAL OF SMOKE AND OXIDES OF SULPHUR FROM FLUE GASES. *Trans. Faraday Soc., 32(8):1291-1296, Aug. 1936. 2 refs.*

A study of absorption-tower packings resulted in a process now in use in Great Britain for the removal of smoke, dust, and acid constituents from boiler flue gas. The scrubbing towers use alkaline water made by adding lime or finely ground reactive chalk to give a thin milk appearance containing 5 to 10% solids. The scrubbing liquid flows over the surface of the scrubbing packing in a thin film for efficient utilization. Turbulence of gas passing through the grid packing is sufficient to throw humidified dust particles onto the liquid film, which then retains them. Schematics are given for the scrubber system and for the plant layout.

1935

34420 **APTIC NO. 57548**

Pearson, J. L., Dr., G. Nonhebel, and P. H. N. Ulander

THE REMOVAL OF SMOKE AND ACID CONSTITUENTS FROM FLUE GASES BY A NON-EFFLUENT WATER PROCESS. *J. Inst. Fuel, 8(39):119-156, Feb. 1935. 43 refs.*

Since modern high-temperature furnaces liberate oxides of nitrogen and hydrochloric acid in addition to oxide of sulfur, the general air pollution around large cities was measured by collecting soluble and insoluble matter in deposit gauges. The deposits gave a decided acid reaction indicative of sulfur oxides pollution. The acidity of the deposits was also shown by the pH of collected rain water: about 5.5 for pure water in contact with air containing the normal proportion of carbon dioxide. In the winter months, the actual sulfur dioxide concentration of ground air in a few localities was 0.2 ppm by volume. In 1932, the extent to which flue-gas cleaning should be undertaken by power stations was considered. The following classification was established for objectionable constituents of flue gas: grit, solid particles from 35 micron upwards; dust, solid particles from 25 micron downwards; and acids of gases, oxides of sulfur, oxides of nitrogen, and hydrochloric acid. Concentration of dust and acid can be plotted, the most useful curves for discussing acid and dust pollution being those obtained by integrating the vertical distribution over unit areas. A non-effluent water system at a pilot plant indicated that water treated with chalk or limestone alkali is effective in cleaning flue gas. By using tanks, slurry pumps, and pipes, the SO2 content in exit gas was reduced to below 20 ppm by volume (0.01 gr sulfur/cu ft). The grid-packed scrubber and other apparatuses used in cleaning boiler flue gases can be used both to clean cement kiln gases and to remove dust from blast furnace plants. Appendices contain information on acid absorption processes and the phenomena of eddy diffusion.

1934

34421 **APTIC NO. 57549**

Applebey, M. P.

RECENT DEVELOPMENTS IN THE CHEMISTRY OF SULPHUR. *J. Soc. Chem. Ind., vol. 53:1097-1101, Dec. 1934. 5 refs.*

The roasting of pyrites and other sulfide ores provides a large proportion of the world s supply of sulfur. Large amounts are lost, however, as sulfur dioxide in the roasting of zinc, copper, lead, and nickel ores. A possible way to obtain an economic value from SO2 is to reduce it to elemental sulfur. The essential reaction of the process is the reduction of SO2 by coke (carbon). In working out a practical process for the utilization of this reaction, two problems had to be overcome, the first arising from the low concentrations of SO2 in the gases and the second from undesirable by-products formed in the reducer. A liquor containing a mixture of salts was effective in concentrating the gases. The circulating solution absorbed 6% of its weight of SO2 from 6.5% gas with 98% absorption of the SO2 present. When heated to 100 C, the solution gave pure SO2 ready for the reducer. The by-products were controlled by making them react with SO2 under the influence of a catalyst. This process can be applied to metallurgical processes, coal desulfurization, and the recovery of sulfur from anhydride or gypsum. Diagrams showing a pilot plant and the international consumption of sulfur in 1929 are included.

34422 **APTIC NO. 57285**

Ward, Alger L. and Claude W. Jordan

GAS PURIFICATION. *United Gas Improvement Co.) U. S. Pat. 1,976,704. 11p., Oct. 9, 1934. (Appl. July 16, 1932, 31 claims).*

A method of purifying fuel gas containing hydrogen sulfide, nitric oxide, and hydrocarbons is described. In the presence of NO the HC form a gum in the vapor phase. To counteract this, the gas is contacted with a porous metallic sulfide which absorbs all of the NO, but not the HC. The hydrogen sulfide is then removed by contacting it with iron oxide. If the gas contains oxygen as well as nitric oxide, hydrogen sulfide, and hydrocarbon gum formers, only part of the hydrogen sulfide is removed. Residual H2S is left to counteract the reaction between oxygen in the gas and the iron sulfide used in the next step. The gas is contacted with a porous iron sulfide to remove the NO without removing the HC gum formers.

1933

34423 **APTIC NO. 57547**

Hewson, G. W., S. L. Pearce, A. Pollitt, and R. L. Rees

THE APPLICATION TO THE BATTERSEA POWER STATION OF RESEARCHES INTO THE ELIMINATION OF NOXIOUS CONSTITUENTS FROM FLUE GASES, AND THE TREATMENT OF RESULTING EFFLUENTS. *Society of Chemical Industry, Proc. Chem. Eng. Group, 1933, p. 67-99. 21 refs. (July 11.)*

The three methods for reducing the amount of sulfur dioxide contained in flue gas are treatment of the coal, dry treatment of the gas, and wet treatment of the gas. Cleaning of coal increases boiler efficiency and reduces boiler maintenance. Addition of lime to coal during combustion is impractical. Similarly, the use of dry absorbents in sulfur dioxide removal from flue gas is unsatisfactory. Sulfur dioxide in flue gas must be converted to a sulfuric acid mist before it is possible to remove it by electrostatic precipitation. The preferred method for removing sulfur oxides from flue gas is scrubbing (wet treatment of the gas), in which the gas containing about 1% sulfur is washed with water, preferably in counterflow, from another chamber. After passing upwards through the water sprays, the gas enters a final scrubber which is wetted with an alkaline solution. The gas is then discharged to the atmosphere after passing through a dry scrubber to remove entrained moisture. The alkaline solution flows downwards and mingles with the water from the water sprays. Treatment of the effluent produced by washing with water or water and dilute alkali is discussed in detail. Analytical methods and calculations used in the investigations, including sampling of the flue gas, sulfur estimation, and carbon dioxide estimation are described. Figures are given for various parts of the washing plants.

1931

34424 **APTIC NO. 57632**

Kershaw John B. C.

CLEANING STACK GASES. *Elec. World, vol. 97:542-546, March 21, 1931.*

Large power stations located within city limits emit noxious stack gases with grit, fine dust, and sulfur acids. A proposed power plant at Battersea Park in London was expected to consume 700,000 tons of fuel per year with a discharge of 30,000 to 40,000 tons of fine dust and 7000 tons of sulfur in the form of sulfur dioxide gas. The removal of these pollutants at a reasonable cost, without interference with the draft has presented problems. Generally, the coarser particles of grit and coke, or unburned fuel, are first removed from the waste gases by a centrifugal apparatus, including the cider-vane dust collector and the Davidson grit catcher which are illustrated. After removal of coarse particles, the gases may be washed by a method and apparatus used by another London power plant. In the operation, how water is used for spraying the gases, and conversion of SO2 to sulfur trioxide is accomplished with a catalytic agent. With a gas velocity of approximately 3 ft/sec, a contact time of 12 sec, and the use of 20 tons of water per ton of coal, 95 to 97% of the sulfur was eliminated. A design for the proposed Battersea plant is given and 14 stipulations are indicated as essential to successful operation. The 1931 estimate of the cost of gas washing, 36 cents/ton of coal burned, is too high.

1929

34425 **APTIC NO. 57250**

Bodenstein, Max

THE KINETICS OF CONTACT SULFURIC ACID AND OUR PRESENT KNOWLEDGE OF ABSORPTION. *(Die Kinetik der Kontaktschwefelsaeure und unsere heutigen Kenntnisse von der Absorption). Text in German. Z. Physik. Chem. (Leipzig), vol. 2:345-348, 1929. 4 refs.*

More than 20 years ago, experimental studies of the reaction velocity of sulfur dioxide with oxygen on platinum were published. The results are still validd, but their interpretation requires modification. It had been assumed earlier that the density of the adsorption layer increases with proximity to the platinum surface. This would explain a rate of oxidation which was solely determined by the SO2 concentration for two SO2:O2 ratios greater than 1.5. More recent investigations have shown that the adsorption layer is monomolecular. This fact can be reconciled with the diffusion-controlled reaction rate if the dominant diffusion direction is assumed not to be perpendicular to the catalyst s surface but parallel, i.e., along the surface toward active spots. This view is also supported by the observed temperature dependence of the reaction rate.

1915

34426 **APTIC NO. 57160**

Garner, James B.

RECOVERY OF SULFUR DIOXIDE. *(Metals Research Co. of New York) U. S. Pat. 1,145,579. 4p., July 6, 1915. (Appl. Dec. 3, 1914, 16 claims).*

The invention describes improved methods for concentration and absorption of sulfur dioxide from gases. The method utilizes animal or vegetable charcoal or coke prepared for use by heating in an inert atmosphere between 250 and 275 C for about 5 hr or between 100 and 125 C for 0.5 hr at reduced pressures. The gas mixture is then passed through a series of charcoal containers at room temperature or below. Increase in absorption occurs as far as -20 C. Recovery of SO2 is accomplished by heating first at 130 C to drive off other gases, then at 180 C to obtain 87 to 98% pure SO2. Recovery of SO2 may also be accomplished under reduced pressures. Both precedures afford reusable charcoal.

MEASUREMENT METHODS

1974

34427 **APTIC NO. 57713**

Bruening, Milton L. and Leroy H. Wullstein

CONTROLLED ATMOSPHERE TECHNIQUE FOR MEASUREMENT OF MOLECULAR NITROGEN, NITRIC OXIDE, NITROUS OXIDE, AND OXYGEN BY GAS CHROMATOGRAPHY. *Environ. Sci. Technol., 8(1):72-75, Jan. 1974. 6 refs.*

A method for minimizing atmospheric contamination during the gas chromatographic analysis of nitrogen, nitric oxide, nitrous oxide, and oxygen was developed. The reaction vessels and a gas chromatograph were enclosed in a controlled atmosphere chamber containing a helium atmosphere with less than 10 to the -10th mol N2 or O2/ml. Detection levels for N2, NO, N2O, and O2 were 8 times 10 to the -10th power, 5 times 10 to the -9th power, 1 times 10 to the -9th power, and 8 times 10 to the -10th power mole, respectively. No satisfactory method for monitoring nitrogen dioxide by gas chromatography was found. Methods are described to produce reliable standard calibration gases. (Author abstract modified)

34428 **APTIC NO. 57703**

Colket, Meredith B., David W. Naegeli, Frederick L. Dryer, and Irvin Glassman

FLAME IONIZATION DETECTION OF CARBON OXIDES AND HYDROCARBON OXYGENATES. *Environ. Sci. Technol., 8(1):43-46, Jan. 1974. 13 refs.*

The catalytic conversion-flame ionization gas chromatographic technique developed to detect trace quantities of the carbon oxides was improved and demonstrated to be a very powerful trace analysis technique for hydrocarbon oxygenates such as formaldehyde. The use of ruthenium or thorium oxide/nickel catalysts significantly reduced the operating temperature necessary for carbon dioxide methanation; thus possible side reactions that might interfere with catalyst life or quantitative conversion were suppressed. Alkanation of unsaturates resulted in increased flame ionization response for hydrocarbon oxygenates. There was no indication that this detection technique, examined over the concentration range of 100-10,000 ppm, would not be effective at concentrations less than 1 ppm. (Author abstract modified)

34429 **APTIC NO. 57714**

Melo, Octavio T. and Colin R. Phillips

AEROSOL-SIZE SPECTRA BY MEANS OF MEMBRANE FILTERS. THEORETICAL STUDY. *Environ. Sci. Technol., 8(1):67-71, Jan. 1974. 22 refs.*

The theory of operation of a Nuclepore filter particle size separator is presented, and a constrained method of solving the resulting equation is evaluated. A method relying on the knowledge of the filtration characteristics of the Nuclepore membrane filters and the ability to measure filter loadings or aerosol concentration is discussed. The loadings or particle concentrations are related to the selective characteristics of the filters and the size spectrum of the aerosol by an integral equation. Methods of solving this equation are presented and evaluated through the simulated sampling of several size spectra. The results are encouraging and suggest the test of such a proposed method of size analysis on real aerosols. (Author abstract modified)

1973

34430 **APTIC NO. 57180**

Alkezweeny, A. J.

A SYSTEM FOR MEASURING PARTICLE SIZE DISTRIBUTIONS. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 140-142, April 1973. 1 ref.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

A modified Royco particle counting system is described which is capable of simultaneously measuring the concentration and size distribution of particles in the size range of 0.3-5 micron diameter in about 100 channels. The aerosol particles are drawn into a Royco Model 220 optical sensor, and the 90-degree light scattering from the individual particles is detected by photomultiplier tube and preamplifier, in the form of a voltage pulse. Calibration and instrumentation are described. (Author abstract modified)

34431 **APTIC NO. 56969**

Amaya, Kazuo

ON THE PROBLEMS OF THE PRESENT SO2 METER. *(Genyo SO2 meta no shomondai). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):256, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 11.)*

Certain questionable data involving sulfur dioxide measurements may be caused by the inaccuracy of presently used measurement apparatus utilizing electroconductivity. Some causes for such inaccuracy may be: high concentration or increase in the concentration of absorbent dilute sulfuric acid; insufficient amount of hydrogen peroxide in the absorbent; uneven air flow caused by filter clogging and other causes; presence of ammonia in the air; presence of sulfuric acid mist captured by filter and does not contribute to electroconductivity; and the fact that under the present condition, all unreliable data are treated as lack of data, since there is no absolutely reliable measurement apparatus. This in turn causes statistical inaccuracy. All these points need improvement.

34432 **APTIC NO. 56971**

Aoki, Hidenobu and Tadanaro Hirao

ANALYSIS OF TOTAL SULFUR OXIDES IN FUEL GAS OF SOLID WASTE INCINERATOR (RESEARCH OF ARSENAZO III METHOD). *(Gomi shokyakuro haigasu-chu no zen io sankabutsu no bunseki ni tsuite (Arso nazo III-ho no kento)). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):251, Oct. 1973. (Presented at the Japan. Society Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 6.)*

The arsenazo III method is suitable for measuring the total sulfur oxide content in solid waste incinerator flue gas; but this method sometimes causes analytical difficulties. The interference factors and elimination methods were examined. The interference of metal ions were examined by adding iron, copper, lead, and zinc ions to sulfuric acid ion and the recovery rate of SO4(--) was tested. It became clear that the Fe ion was the interference factor in the arsenazo III method, and ion exchange resin was applied for elimination of Fe ion. It was most effective, but elimination of hydrogen peroxide was necessary before passing the gas through ion exchange resin. The stainless sampler tube for flue gas was corroded by the high temperature, water content, hydrogen chloride, and sulfur oxides in the gas and iron ion was released into absorbent. The use of glass sampling tubes can solve the problem to a certain extent, but it will limit sampling in strength and temperature factors. Therefore, the use of ion exchange prior to the arsenazo III method would be suitable in analyzing SOx in incinerator flue gases.

34433 **APTIC NO. 57357**

Askne, Christer, Cyrill Brosset, and Martin Ferm

DETERMINATION OF THE PROTON-DONATING PROPERTY OF AIR-BORNE PARTICLES. *Preprint, Swedish Water and Air Pollution Research Lab., Gothenburg (Sweden), 30p., Aug. 1973. 6 refs.*

A method for the determination of the proton-donating (acidifying) property of airborne particles has been developed on the basis of observations of particle properties in a large number of samples collected in Sweden, followed by theoretical considerations and measurements in synthetic systems. The observations revealed that the acid properties of particles can be caused by their content of one or more of the following components: free hydrogen ions, hydrogen sulfate ions, iron (III)-ions in water-soluble compounds, aluminium ions in water-soluble compounds, and ammonium ions. The method of determination involved sampling with a Fluoropore filter by Millipore and titration (thermostatically controlled). Titration curves are illustrated for: 2 times 10 to the minus 4 N sulfuric acid; a strong acid with iron salt; a mixture of strong acid and aluminum salt with identical molar concentrations; and a solution containing strong acid as well as iron salt and aluminum salt, where the concentration of strong acid is considerably higher than that of the iron and aluminum salts. Descriptions and specifications are also provided for the equipment used.

34434 **APTIC NO. 57305**

Becka, J. and P. Ocelka

SIMULTANEOUS GAS-CHROMATOGRAPHIC DETERMINATION OF TRACE QUANTITIES OF ETHYLENE AND CARBON DIOXIDE IN THE AIR OF CONTAINERS USED FOR BIOASSAYS. *(Gleichzeitige gaschromatographische Bestimmung von Aethylene- und Kohlendioxidspuren in der Luft biologischer Versuchskontainer). Text in German. Collection Czech. Chem. Commun. (Prague), 38(8):2242-2248, Aug. 1973. 14 refs.*

A method for the simultaneous gas-chromatographic determination of ethylene and carbon dioxide, present in inhalates from ripening fruits, is described. Ethylene and CO2 are first hydrated in the presence of a nickel-thorium oxide catalyst applied on silica gel. Ethylene is hydrated first into ethane in a temperature range of 18-40 C, and further decomposed into methane in a temperature range of 200-300 C, while CO2 is hydrated directly into methane in a temperature range of 130-500 C. The rates of CO2 and ethylene conversion are 99.1 and 100%, respectively. Determination is then done by means of flame-ionization detector. Ethylene and CO2 were determined in concentrations of 0.001% and 0.01% in air samples of 1 to 2 ml.

34435 **APTIC NO. [illegible]**

Benarie, M. Callais, B. T. Chuong, B. Pontvianne, R. Simon, and S. Zakartchenko

MEASURING THE SO2 CONCENTRATION IN SLIGHTLY POLLUTED AIR. *(Mesure de la teneur en SO2 en zone faiblement polluee). Text in French. Pollut. Atmos. (Paris), no. 59:281-290, July-Sept. 1973. 6 refs.*

Two spectrophotometric methods (West and Gaeke method using sodium tetrachloromercurate, and the Bourbon-Malbosc method using zinc-pyridine acetate) for the determination of low sulfur dioxide concentrations in the air are compared. The modified Bourbon-Malbosc method features high fidelity, simple manipulation, and rapid development of the coloration in an aqueous medium containing 80% glycerine. The limit of detection is 0.2 micrograms of SO2 per cu cm of absorbent solution. The absorption efficiency, though lower than that of the West and Gaeke method, is acceptable. The possible loss of SO2 is due to the protracted complex formation. The West and Gaeke method features high fidelity and excellent SO2 absorption without loss of SO2 in the course of sampling. The limit of detection is 0.1 micrograms of SO2 per cu cm of absorbent solution. However, the coloration takes up to 8 hr for complete development.

34436 **APTIC NO. 57585**

Bohl, Carl David

THE EVALUATION OF THE FEASIBILITY TO DEVELOP AN INSTRUMENT TO DETERMINE PARTICLE SIZE BY TOTAL SCATTERGRAM. *Cincinnati Univ., Cincinnati, Ohio, Dept. of Environmental Sciences, Thesis (D. Sci.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1973, 160p. 47 refs.*

An experimental instrument for measuring the light scattered from a cloud of particles was designed and constructed for the purpose of determining particle size via total scattergram. The device employs a helium-neon laser as its light source, a photomultiplier for detecting the scattered light, a logarithmic amplifier and computer for processing and storage of the signal, and an x-y plotter for drawing the final scattergram. Scattergrams from each of three clouds of different size particles, charged to the same maximum concentration, were recorded; and statistical analyses of these scattergrams indicated that they were different at the 95% confidence level. The difference observed in the scattergrams was the result of the various particle sizes since the mass concentration of the three particles was equal. A change in intensity of the scattered light was not found directly proportional to a change in the relative particle spacing of the particles in the cloud due to a lack of sensitivity inherent in the experimental instrument. (Author summary modified)

34437 **APTIC NO. 57325**

Borkowska, Maria and Artur Strusinski

COLORIMETRIC METHODS OF DETERMINING ANILINE AND PHENOL IN ATMOSPHERIC AIR. *(Kolorymetrymetryczne metody oznaczania aniliny i fenolu w powietrzu amosferycznym). Text in Polish. Roczniki Panstwowego Zakladu Higi., 24(4):485-492, 1973.*

The colorimetric methods of aniline and phenol determination in atmospheric air are compared. Two variants of the determination of aniline by the indophenol method are described. One of them is based on determination at boiling temperature of the aniline absorbed in a 0.25 n solution of hydrochloric acid in the presence of phenol and a 1% active chlorine reactivant. The second method is based on the generation of indophenol at cold temperatures as a result of a reaction between the aniline absorbed in a 0.1 n sulfuric acid solution in the presence of 3% phenol and 1% active chlorine solutions. The second method is rapid, easy, and accurate, permitting the determination of 500 ng aniline in a 5 cu cm sampler. For best results the following method is recommended: to 100 cu cm 3% phenol solution, 0.1 g salicilic acid is added. A 2% sodium hydroxide and a 0.1 n sodium hydroxide solution are used. Two to three drops of aniline are added to the 0.1 n H2SO4 so as to obtain 0.01 mg/cu cm aniline/solution. After mixing the reactivants, the transmission should be measured on a photocolorimeter for a wavelength lambda equals 620 nm, after a lapse of 15 min. Measurement methods for phenol determination are the iodimetric and bromometric methods. Colorimetric methods are more accurate, however. The best is Hilper and Gill s method, based on the formation of azo dye with p nitroaniline being the diazo component, at low temperatures ranging from 0 to 5 C in a HCl medium. In colorimetric samplers, to 0.010 mg phenol, absorbing liquid is added up to 5 cu cm. Then, 0.1 cu cm two azo p nitroaniline is added. After mixing, the transmission value of each sample is determined on the photocolorimeter at a wavelength lambda equals 495 nm. The transmission can be determined 15 min after adding the p nitroaniline. The sensitivity of this method is 500 ng in a 5 ml sample.

34438 **APTIC NO. 57784**

Brocco, D., V. DiPalo, and M. Possanzini

IMPROVED CHROMATOGRAPHIC EVALUATION OF ALKANES IN ATMOSPHERIC DUST SAMPLES. *J. Chromatog., 86(1):234-238, Nov. 1973. 3 refs.*

A selective method for separating and identifying alkanes using a preparative thin layer chromatographic (TLC) step to the cyclohexane solution followed by a gas chromatographic (GC) evaluation is described. High boiling n-alkanes occur extensively absorbed on air-borne particulate matter. Their presence may be attributed to several sources, such a heating plants, the burning of oil or coal, and car exhaust fumes. These hydrocarbons, with either an even or uneven number of carbon atoms, seem to be common components of urban dust. The existence of a large variety of components, polycyclic hydrocarbons, heterocyclic, and hydrophilic compounds, in association with alkanes in the organic dust fraction necessitates a preliminary analytical separation. The method can be used for the routine analysis of aliphatic hydrocarbons adsorbed on airborne particles. Because of the very sharp thin layer separation of different classes of compounds, the direct application on the plate of a small amount (50 mg) of the atmospheric dust on a thin line at the starting point would also be possible. (Author conclusions modified)

34439 **APTIC NO. 57204**

Carter, J. A., R. L. Walker, and J. R. Sites

TRACE IMPURITIES IN FUELS BY ISOTOPE DILUTION MASS SPECTROMETRY. *Am. Chem. Soc., Div. Fuel Chem., Preprints, 18(4):78-91, 1973. 11 refs. (Presented at the American Chemical Society, National Meeting, 166th, Chicago, Ill., Aug. 26-31, 1973.)*

Spark source and thermal emission mass spectrometry were studied for determining trace elements in coal-fired central power plants. Isotope dilution methods were used for analyses of lead, cadmium, and mercury in gasolines and other petroleum fuels. Instrumentation is described. Spark source mass spectrometry was used to analyze pulverized coal and fly ash. Isotope dilution by spark source mass spectrometry and by thermal emission mass spectrometry were used to determine composition of coal. fly ash, gasoline, and fuel oil. Nominal coal analysis indicated a composition of 9.5% moisture, 34% volatiles, 43% fixed carbon, 13% ash, and 3.4% sulfur. The metal balance for all elements analyzed by mass spectrometry was good, but on the average had a negative imbalance of 20%. Metals with high imbalance, such as mercury, arsenic, and selenium probably were in the gaseous state at the sample points. An example was mercury in which a precipitator outlet sample showed a flow of 0.02 g/min, and at the point of sampling, the particulates were much cooler than the fly ash at the precipitator inlet. The average imbalance for the elements measured by isotope dilution mass spectrometry with lower volatility showed an imbalance range from -8% to +12%, these results indicate the usefulness of mass spectrometry in evaluating environmental impacts.

34440 APTIC NO. 57203

Church, D. A., T. Hadeishi, R. D. McLaughlin, and B. D. Zak

COHERENT FORWARD SCATTERING AS A SENSITIVE MEANS FOR TRACE ELEMENT DETECTION. *Am. Chem. Soc., Div. Environ. Chem., Prepr., 13(2):47-50, Aug. 1973. 5 refs. (Presented at the American Chemical Society, National Meeting, 166th, Chicago, Ill., Aug. 26-31, 1973.)*

Coherent forward scattering as a function of magnetic field strength in polarized optical resonance radiation scattered in a forward direction was used to detect trace elements. The apparatus was used to detect small concentrations of mercury in air by replacing the closed cell with an open absorption tube. Absorption signals for mercury vapor and benzene vapor in air were made with the same apparatus with zero field strength applied to both the lamp and the atoms in the absorption region, and with the final polarizer removed. Substantial relative interference can be tolerated, and minute densities of mercury can be observed.

34441 APTIC NO. 57202

Dietz, Russell N., Edgar A. Cote, and James D. Smith

A NEW METHOD FOR CALIBRATION OF PERMEATION WAFER AND DIFFUSION DEVICES. *Am. Chem. Soc., Div. Environ. Chem., Prepr., 13(2):39-46, Aug. 1973. 9 refs. (Presented at the American Chemical Society, National Meeting, 166th, Chicago, Ill., Aug. 26-31, 1973.)*

Permeation tubes are used as standard reference materials for calibrated sources of gaseous pollutants to provide improved calibration of air monitoring instruments. A new volumetric method for the calibration of permeation wafer and diffusion devices for both non-condensible and condensible gases was studied experimentally. It could determine rates of less than 5 ng/min in hours instead of weeks. The modified apparatus for permeation tubes was used to determine the rate for sulfur dioxide permeation tubes at 30, 50.5, and 60 C; an activation energy of 12.6 kcal/g mol was obtained. Evaluation of methane diffusion in a capillary stainless steel tube gave high diffusion rates and good reproducibility. Lower methane diffusion rates were achieved with a Swagelok restrictor. In a nitrogen dioxide run with the permeation wafer device, a 200 ng/min permeation rate was determined with 2% precision from five measurements taken over 2.5 hours. With the use of digital thermometers in the place of the mercury thermometer, a threefold improvement in the precision should be obtained. The comparative times to obtain several permeation rates by various techniques are given.

34442 APTIC NO. 57523

Dzubay, T. G. and R. K. Stevens

APPLICATIONS OF X-RAY FLUORESCENCE TO PARTICULATE MEASUREMENTS. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., Chemistry and Physics Lab., 8p., 1973. 10 refs. (Presented at the Joint Conference on Sensing of Environmental Pollutants, 2nd, Washington, D. C., Dec. 1973.)*

A system for determining the composition of atmospheric aerosols according to size as a function of time is described. Central to the system is an x-ray fluorescence spectrometer for determining the elemental composition of particulate matter collected on filters. To optimize the sensitivity for elements with atomic numbers above 12, each sample is analyzed by exciting it with characteristic x-rays from each of the secondary fluorescers copper, molybdenum, and terbium. Samples were collected in St. Louis using a device which manipulates up to 36 filters into an air stream for preadjustable collection periods. Particles were also collected in St. Louis using a new dichotomous sampler which uniformly deposits aerosols in the 0-2 micron and 2-10 micron size ranges on two separate filters suitable for x-ray analysis. The elements surfur, manganese, zinc, bromine, and lead occurred mainly in the small particles, while most of the silicon, cadmium, titanium, and iron occurred in the large particles. The most abundant observed element was sulfur in the form of sulfate. The diurnal patterns of the elements gave valuable clues about the source of the pollutants. (Author abstract modified)

34443 APTIC NO. 57525

Dzubay, T. G., H. L. Rook, and R. K. Stevens

A CHEMILUMINESCENT APPROACH TO MEASUREMENT OF STRONG ACID AEROSOLS. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., National Environmental Research Center, 21p., 1973. 8 refs.*

An instrument for monitoring strong acids in real time without going through the collection and extraction operations of other methods is described. Strong acid aerosol is detected by its gas phase reaction with ammonia, which is supplied at a constant rate by a permeation tube. Then the ammonium salts are removed by a filter, and the ammonia remaining is converted to nitric oxide in a heated converter. The NO is then detected in a chemiluminiscence monitor. For a commercial chemiluminescence monitor, the typical sensitivity is 5 ppb for NO which corresponds to a molar equivalent of 8 micrograms/cu m of sulfur trioxide. The stability of the chemiluminescence monitor against periodic flow resistance changes was studied experimentally. The conversion of NH3 to NO was quantitative and the reaction of the acid aerosol with ammonia was complete. Effects due to humidity changes, to reactions with weak acids, and to wall losses must be minimized. The instrument gave a clear and unique response to sulfuric acid aerosol, and slowly varying background levels of NO and nitrogen dioxide were tolerated. The detection limit was about 20 micrograms/cu m for H2SO4 aerosol. The sensitivity for strong acid aerosols will improve as more sensitive NO monitors are developed. Improved design techniques which minimize the retention time of NH3 on the walls of the system would shorten the period of operation.

34444 APTIC NO. 57532

Dzubay, T. G., B. V. Jarrett, and J. M. Jaklevic

BACKGROUND REDUCTION IN X-RAY FLUORESCENCE SPECTRA USING POLARIZATION. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., Lab. of Chemistry and Physics and California Univ., Berkeley, Lawrence Radiation Lab., 10p., June 1973. 7 refs.*

X-ray fluorescence spectra were observed by exciting a sample with both polarized and unpolarized radiation. A significant reduction in the magnitude of the scattering peaks and background resulted from the use of polarization. The sample was a leaf. Energy dispersive x-ray fluorescence analysis can be used for trace element analysis of environmental and biological samples. (Author abstract modified)

34445 APTIC NO. 57315

Fischer, Gyorgy, Zsofia Fodre, and Maria Nehez

ELABORATION OF NORMS FOR THE ASSESSMENT OF THE BACTERIOLOGICAL AIR POLLUTION IN PUBLIC HEALTH INSTITUTIONS. *(Torekves normativak kidolgozasara a levego bakteriologiai szennyezettsegenk megiteleschez egezsegugyi intezmenyekben). Text in Hungarian. Egeszsegtudomany, no. 17:250-258, 1973. 24 refs.*

A simple standard method for germ counting in different public health institutions, and limit values for germ concentrations in the air are proposed. The simple Koch sedimentation method and blood agar in Petri scales as substrate were used for air sampling for the bacteriological investigations. The Petri scales were placed horizontally, at 80-100 cm above floor, and 100-150 cm off extended vertical surfaces. Petri scales placed vertically retained hardly any germs. The number of Petri scales to be exposed in one room was to be best between 10 and 20. Sixty-six percent of all measurement data obtained for the same type of rooms were rated as good, 90% as acceptable, and the residual 10% were rated as unsatisfactory. Expressed in sq dm/h, the germ counts in operating rooms prior to operation were rated to be good between 0 and 4, acceptable between 5 and 8, and unsatisfactory over 9. The corresponding norms for operating rooms during operations are 0-60, 61-90, and over 90. The norms for sick wards are 0-450, 451-750, and over 750, and those for ambulatory clinics are 0-130, 131-350, and over 350.

34446 **APTIC NO. 57762**

Fusamura, Nobuo and Makoto Mori

SIZE DISTRIBUTION AND PROPERTIES OF AIRBORNE PARTICULATED MATTERS. *(Fuyu ryushijo busshitsu no ryudo to tokusei). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):321, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 67.)*

To improve the efficiency of the cascade impacter, various devices were made to increase the amount of samples captured in a short time. When an optical microscope cover glass or aluminum foil is placed on the metal plate, the substances captured on the plate could be examined by a balance and microscope. For microscopic observation alone, 30 min of sampling in a normal concentration of suspended particulate will yield enough by utilizing this method. Samples captured at the rate of 11 l/min showed many grease particles of maximum size 50 micron on the first and second plates. Particles of opaque material less than 1 micron in size were noted in a large quantity. The grease material did not evaporate in the desiccator, but did when heated directly by an alcohol lamp. It is acidic, and the solid particle seems to be surrounded by a greasy, transparent material. The quantity captured on the fifth and sixth levels was the greatest. The same material was noted in the sampling captured in a static dust sampler tube. Suspended particulates in the urban environment contain a large quantity of acidic grease-solid particulates in sizes larger than 1 micron.

34447 **APTIC NO. 57675**

Hare, Charles T. and Karl J. Springer

EXHAUST EMISSIONS FROM UNCONTROLLED VEHICLES AND RELATED EQUIPMENT USING INTERNAL COMBUSTION ENGINES, PART 4: SMALL AIR-COOLED SPARK IGNITION UTILITY ENGINES (FINL REPORT) Southwest Research Institute, San Antonio, Tex., Environmental Protection Agency Contract EHS 70-108, APTD-1493, AR-888, 111p., May 1973. 20 refs.

NTIS: PB-224885/4AS

Exhaust emissions from five gasoline-fueled, air-cooled utility engines were measured using two types of steady-state procedures. Some measurements were taken during transient operation. The two procedures used for small-engine tests were a 9-mode procedure which was being recommended by the Society of Automotive Engineers at the time the tests were run, early 1971, and a modified version of the EMA-California 13-mode procedure. The exhaust products measured during the emissions tests included total hydrocarbons by FIA; hydrocarbons, carbon monoxide, carbon dioxide, and nitric oxide by NDIR; oxygen by electrochemical analysis; light hydrocarbons by gas chromatography; total aliphatic aldehydes and formaldehyde by the MBTH and chromatropic acid methods, respectively; particulates by an experimental dilution-type sampling device; and exhaust using a PHS full flow smokemeter. The engines were operated on small electric dynamometers, and the emissions results are used in conjunction with statistics on utility engine population and usage to estimate national emissions impact. (Author abstract modified)

34448 **APTIC NO. 57689**

Huebner, Victor R.

DEVELOPMENT OF IMPROVED SYSTEMS FOR OBTAINING TIME INTEGRATED MEASUREMENTS OF SO2, NO2, NOX, AND OTHER POLLUTANTS. *Instra-Tech, Inc., Fullerton, Calif., Environmental Protection Agency Contract 68-02-0318, Program Element 1A1010, EPA-R2-73-207, 67p., Jan. 1973.*

NTIS: PB 225125/4AS

Improved methods for the detection and recording of weak light emission resulting from the chemiluminescent reaction of air pollutants such as sulfur dioxide, ozone, and oxides of nitrogen with specific gaseous reactants were investigated. Major emphasis was placed on attempting to use photographic film as both a detector and integrator for the light emission with the intent of exposing the film to the chemiluminescent reaction, developing the film, and relating the film density to accumulated air pollutant. The approach, however, was unsatisfactory due to the film s poor sensitivity. One of the more important findings of the experiments was that the chemiluminescence reaction is primarily limited by physical mixing efficiency of the reactants. Long, narrow reaction chambers provided much better mixing efficiency, although optical reflectance losses counteracted any improved mixing efficiency with excessively narrow tubes. Another major finding was that permeation tubes could be effectively used to meter in the reactant gas; this may make it possible to eliminate the need for auxiliary reactant gas cylinders. A photon counting system was explored as a means of increasing the reliability and reducing the cost of chemiluminescent detectors, and such a system was developed to amplify each photoelectron, discriminate against noise pulses, accumulate all the photon counts, and display the sum of the counts on a 5 by 7 light emitting diode display. (Author summary modified)

34449 **APTIC NO. 56991**

Ihata, Yoshio and Yoshinari Kurosaka

COMPARATIVE MEASUREMENTS OF COLORIMETRY AND COULOMETRY IN ATMOSPHERIC OXIDANT. *(Taikichu okishidanto no hishokuko to denryoho no hikaku sokutei). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):264, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 19.)*

The measurement of oxidants in the air was taken by neutral KI colorimetry and coulometry, and the results were compared. The measurements of nitric oxide and nitrogen dioxide were also compared. The period of measurement was 30 days between March and April of 1973. The air-liquid content method for colorimetry was by counterflow absorption tube and for coulometry a force contact. Nitrogen oxides were measured by the Saltzman method. The number of days exceeding 0.1 ppm of oxidant concentration was 10 days by colorimetry and 6 days by coulometry, during which, 4 extra days by colorimetry were caused by high concentration of NOx at night. The daily average of the colorimetry/coulometry ratio was 1.1 to 4.3; the large values were the effects of NOx. Effects of NOx on coulometry were negligible. The formula for the adjustment of coulometry value is: measurement of oxidants minus 0.05 (NO2 plus 0.9 times NO). The adjustment for colorimetry is obtained by replacing 0.05 by 0.25.

34450 APTIC NO. 57749

Kim, A. G. and L. J. Douglas

A GAS CHROMATOGRAPHIC METHOD FOR ANALYZING MIXTURES OF HYDROCARBON AND INORGANIC GASES. *J. Chromatographic Sci., 11(12):615-617, Dec. 1973. 8 refs.*

A simple gas chromatographic method was developed for analyzing complex mixtures of organic and inorganic gases; it is versatile, sensitive, and readily adapted to different types of samples, varying in size and composition. Inorganic gases and methane were detected by a thermal conductivity detector; methane and trace amounts of C2 through C5 hydrocarbons were detected by a flame ionization detector. Oxygen, nitrogen, hydrogen, helium, and carbon dioxide were the inorganic compounds tested. Porapak and molecular sieve columns were used with argon as the carrier gas. A column selector valve made it possible to perform a complete analysis either on one 1 ml sample in 40 min, or on two 1 ml samples in 20 min. Samples were introduced either by on-column injection or through a gas sampling valve. By varying operational parameters, the speed, sensitivity, and accuracy of analysis could be modified. (Author abstract modified)

34451 APTIC NO. 56992

Kimoto, Toshio, Akira Miura, and Keiji Sodeyama

COMPARISON STUDY FOR MEASUREMENT OF NOX. *(Chisso sankabutsu no kagaku hakkoho ni yoru sokuteichi ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):255, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th Fukushima, Japan, Nov. 6-8, 1973, Paper 10.)*

The ozone interference problem for the Saltzman method of measuring nitrogen oxides, the fluctuation of the Saltzman coefficient by nitric oxide and nitrogen dioxide concentration differences, the linear formation of chemiluminescence measurements, and measurements by the Saltzman method and chemiluminescence method were compared and examined in this experiment. The apparatus structure and flow chart, comparative specifications, and results are presented. An overall examination of the O3 interference factors, Saltzman coefficient, linearity, response speed, reliability, and repeatability suggest the superiority of chemiluminescence over the Saltzman method.

34452 APTIC NO. 57770

Kucerovsky, Z., E. Brannen, K. C. Paulekat, and D. G. Rumbold

CHARACTERISTICS OF A LASER SYSTEM FOR ATMOSPHERIC ABSORPTION AND AIR POLLUTION EXPERIMENTS. *J. Appl. Meteorol., 12(8):1387-1393, Dec. 1973. 19 refs.*

The design and performance of a double-beam laser transmitter and receiver system are described. The transmitter consists of two cw helium-neon lasers, one working at 0.6328 micron (used as a guide beam), and the other at 3.392 micron, and two beam expanders which result in transmitted beam divergences of 0.1 and 0.4 mrad, respectively. An 8-inch Newton telescope coupled to a triglycine sulfate pyroelectric detector was used as a receiver. The value of the absorption coefficient of methane in dry air at 760 torr for 3.392-micron laser radiation was k equals 1.01 + or - 0.01/torr/m in a laboratory experiment. The value of absorption coefficient was 20% higher for air containing 7% by volume of water vapor. In outdoor measurements, a homogeneous concentration of methane of 1 ppmv decreased the transmitted signal by 10% for an effective path length of 130 m. The system was used for detection of point leaks of methane. For a beam transmitted 1 m above the ground level, a simulated leak of 100 cu cm of methane (released in 1 min) caused an 8% decrease of transmitted signal. The range of the transmitter-receiver was 0.5 km for the full beam (1/sq e width) collected by the receiver or 5 km with one additional beam expander. The system seems suitable for communication experiments, long-path or folded-path spectroscopy, and atmospheric pollution measurements. For monitoring methane in the ambient air or near industrial sources, the sensitivity of the method is the product of the volume concentration and the measuring path length equal to a constant, 127 ppmv m. The sensitivity in the case of measuring leaks can be estimated in terms of the transmittance equal to exp(-8.3 times the volume concentration of methane times the linear size of the leak). (Author abstract modified)

34453 APTIC NO. 57288

Kuhn, John K., William F. Harfst, and Neil F. Shimp

X-RAY FLUORESCENCE ANALYSIS OF WHOLE COAL. *Am. Chem. Soc., Div. Fuel Chem., Preprints, 18(4):72-77, 1973. 5 refs. (Presented at the American Chemical Society, National Meeting, 166th, Chicago, Ill., Aug. 26-31, 1973.)*

An x-ray fluorescence spectrometer was used to determine a number of trace and minor elements in pressed whole coal samples and coal ash. The technique was originally intended to establish major element matrix formation on coal ashes to be analyzed for trace elements by optical emission spectroscopy. The accuracy of the x-ray fluorescence method was limited by the accuracy of the methods used for obtaining the trace element concentrations that were employed in preparing calibrations. X-ray matrix corrections were made for the analysis of whole coal. For most purposes, acceptable precision could be obtained on -200 mesh coal. Further improvement was achieved on grinding to -325 mesh, but this would be unnecessary except for analyses to be used as standard values or for other special purposes. Good agreement of whole coal results obtained by x-ray fluorescence occurred with values determined by several other independent methods. Variations at higher trace element concentrations, especially for more coarsely ground coals, were due to sampling errors caused by discrete mineral particles in whole coal. Trace element determinations were limited to elements occurring in concentrations of a few ppm or greater.

34454 APTIC NO. 57752

Kubota, Masahiko, Yoshinori Kurata, Kotatsu Omoto, and Yasuhiro Sasaki

DETERMINATION OF NITROGEN OXIDES IN AIR BY LEAD DIOXIDE METHOD. *(Nisankaen-ho ni yoru chisso sankabutsu no sokuteiho no kento). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):258, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 13.)*

Application of the lead dioxide method to measurement of nitrogen oxides was examined by comparing the results with those of the alkaline filter paper method. The measurements were taken in Mishima and Fukuyama in 1970 and 1973. The results were presented in tables. In the measurements of November and December 1970, the figures at two locations are high for both the lead dioxide measurements and the alkaline filter paper measurements, though the figures do not agree. The pollutants from automotive exhausts in the measurement locations seemed to have affected the figures. The correlation was high between figures of sulfur oxides obtained by the both methods, but there was no correlation between the figures for NOx in the Fukuyama area. The reason might be that the exclusivity of the alkaline filter paper method yields only the measurement of nitrogen dioxide, whereas the lead dioxide measurements are affected by other NOx elements. Further studies will be made on this matter.

34455 APTIC NO. 57142

Lee, R. N.

TRACE METAL ANALYSIS BY ATOMIC ABSORPTION SPECTROMETRY USING A GRAPHITE FURNACE

ATOMIZER. In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences, Part I. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 85-87, April 1973. 3 refs.

NTIS: BNWL-1751 PT1, UC-53 Meteorology

Atomic absorption spectrophotometry using a carbon furnace technique was evaluated to determine its applicability to atmospheric tracer and pollution studies. Observed analytical sensitivities are given for beryllium, chromium, copper, indium, iron, lead, lithium, manganese, nickel, silver, and zinc. Aqueous solutions were more effectively handled than gaseous and solid samples. Aqueous samples should be acidified with nitric acid. The effects of various drying and ashing techniques are mentioned.

34456 **APTIC NO. 57648**

McCain, J. D., K. M. Cushing, and A. N. Bird, Jr.

FIELD MEASUREMENTS OF PARTICLE SIZE DISTRIBUTION WITH INERTIAL SIZING DEVICES (SPECIAL REPORT). *Southern Research Inst., Birmingham, Ala., Environmental Protection Agency Contract 68-02-0273, ROAP 21ADM11, Program Element 1ABO12, EPA-650/2-73- 035, SORI-EAS-73-299, 52p., Oct. 1973. 3 refs.*

NTIS: PB-226292/AS

A comprehensive particle size measurement program conducted at a coal-fired electric generating plant early in 1973 is discussed. Information obtained from other field tests and laboratory work are included. The primary particle size range of interest is from 0.2 to 2.0 micron in diameter, but techniques are also evaluated from measuring larger particles. Inertial classification and cascade impactors are the basic sizing techniques considered. Among the 11 different commercial and modified sizing devices evaluated are Andersen Models II, III, and IV; Battelle CIS-6, Brink BMS-11; McCrone; TAG; and University of Washington Mark III. No single device was useful over the entire range of particle size and concentration needed for evaluation of a wide variety of particulate control devices. (Author abstract modified)

34457 **APTIC NO. 56997**

Mieure, J. P. and M. W. Dietrich

DETERMINATION OF TRACE ORGANICS IN AIR AND WATER. *J. Chromatographic Sci., vol. 11:559-570, Nov. 1973. 12 refs. (Presented at the Summer Symposium on Analytical Chemistry, 26th Annual, Oxford, England, June 1973.)*

Several procedures are described to analyze trace organic compounds in air and water. First the organics are concentrated and isolated from the matrix, then the components of interest are identified, and finally the identified compounds are measured. The second two operations are based primarily on gas chromatography (GC) and utilize relatively standard procedures. These are the same for air or water. However, the concentration and isolation techniques differ considerably, depending on the matrix. In air, gas chromatographic columns are used. Collection columns 4-6 in. long containing porous polymer bead packings coupled into the GC were used during tests of this technique. High flow rates (0.5-2 l/min) were possible with inexpensive, portable vacuum pumps, which permitted short sampling times and maximum sensitivity. Total sampling and analysis time was about 30 min for typical air pollutants. Water vapor did not interfere with analysis. These columns were used satisfactorily for collecting organics at temperatures up to 90 C. The high sensitivity of the procedure was calculated for an air flow rate of 2 l/min and a 10-minute sampling interval. Using a flame ionization detector capable of detecting 10 nanograms, components present at 0.5 m micrograms/cu m could be measured. For components with molecular weights of about 100, this corresponds to 1 ppb. Sampling larger volumes of air gave proportionally lower detection limits. Phthalate esters were measured in the air inside a new car to determine if these plasticizers used in vinyl automobile upholstery are responsible for fogging automobile windows. The level of volatile components were constant at 10-12 micrograms/l regardless of temperature. Phthalate ester concentration varied from less than 0.1 micrograms/l at 25 C to 0.3 micrograms/l at 55-60 C. A flow cell was developed to estimate concentration of organics evolved to air from various substrates under a variety of use conditions. Plasticized film, tiles, and other thin samples were tested in the cell. Volatile organics were also measured in the ambient air and stack gases near manufacturing sites. This procedure was also used to measure odors. Trace organic water pollution analysis is also discussed.

34458 **APTIC NO. 56990**

Muramatsu, Manabu, Akiko Seki, Shinkichi Miyai, and Masaki Mori

ANALYSIS OF GASEOUS AMMONIA IN ATMOSPHERE BY ION-ACTIVE ELECTRODE. *(Ion denkyokuho ni yoru taikichu ammonia nodo sokutei). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):2[illegible]2, Oct. 1973. (Presented at the Japan Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 17.)*

The sampling method and performance of ion-activated electrode measurements of ammonia were examined. Boric acid 10 ml (either 0.5 or 0.25%) was taken into a misette impinger and the sample gas was passed at 1 l/min for 1-2 hours. When the NH3 gas concentration was 0.5-0.9 ppm, the best absorption rate was repeatedly obtained. When using 0.5% boric acid, the measurements of one-hour and two-hour samplings agreed very well. The results of the ammonia electrode method was compared with the indophenol method measurements and they agreed completely. Interferences of sulfur dioxide 0.26 ppm was -0.009-(minus)0.0017 ppm (converted into NH3 gas value), of nitric dioxide 0.5 ppm was 0.000-0.003 ppm, and that of carbon dioxide 1000 ppm was 0.000 to (minus)0.002 ppm.

34459 **APTIC NO. 57346**

Novikov, Yu. V.

THE USE OF NEUTRON ACTIVATION ANALYSIS IN HYGIENE. *(Ispol zovaniye neytronno-aktivatsionnogo analiza v gigiyene). Text in Russian. Gigiena i Sanit. no. 10:79-85, 1973. 12 refs.*

Uses of neutron activation analysiis in hygiene are reviewed. Apart from being suitable for the determination of trace elements and residues in biological materials and soil, neutron activation analysis can be used for the identification of air pollution sources, and for the determination of air pollutants and atmospheric aerosol components in a nearly automatic manner. Gamma-spectrometers with germanium-lithium semiconductor detectors are especially suitable for the simultaneous analysis of several components. The detectability of aluminum, sulfur, calcium, sodium, magnesium, chlorine, arsenic, chromium, iron, cobalt, selenium, and mercury in urban aerosols is 0.008, 5, 0.2, 0.04, 0.6, 0.1, 0.004, 0.00025, 0.02, 0.000025, 0.2, and 0.0001 micrograms/cu m, respectively.

34460 **APTIC NO. 57236**

Parker, Clive R., John Rowe, and Dennis P. Sandoz

METHODS OF ENVIRONMENTAL CADMIUM ANALYSIS BY FLAMELESS ATOMIZATION. *Am. Lab., 5(8):53-59, Aug. 1973. 12 refs.*

Sources of cadmium are reviewed, and a nonflame atomization technique is described for the analysis of the element in various matrices. A carbon rod, nonflame atomization analyzer which is available in tube or cup configuration has proven 130 times more sensitive than the flame technique for analysis of cadmium. Atomic absorption spectrophotometry is used as the peak detector. Both the cup and tube are coated with pyrolytic carbon (an extremely inert coating) which results in easier operation and greater reproducibility by preventing soaking of the sample into graphite. The cup can be used as a chemical reaction vessel by placing an aliquot of the sample in its bottom. It is possible to add a reagent immediately afterwards and carry out wet ashing, thus preventing some forms of interference which may otherwise be encountered such as loss of volatile metal chlorides during the ashing stage. A peak detector can be triggered automatically by the carbon rod atomizer, scan for 10 sec, and display the peak signal digitally or on a recorder, permitting print-out or data acquisition for computer processing. Samples of airborne cadmium may be dried, ground, and dispersed in acid or may be placed directly on the rod; the former method is more practical as a larger but more homogeneous sample is used. Cadmium in food, water, and tissues can also be measured.

34461 **APTIC NO. 57641**

Pattnaik, Amitav and John D. Meakin

DEVELOPMENT OF AN INSTRUMENTAL MONITORING METHOD FOR MEASUREMENT OF ASBESTOS CONCENTRATIONS IN OR NEAR SOURCES. *Franklin Inst. Research Lab., Philadelphia, Pa, Environmental Protection Agency Contract 68-02-0544, Program Element 1AA010, EPA-650/2-73-016, Rept. F-C3415, 48p., June 1973. 36 refs.*

NTIS: PB-226471/AS

The development of an instrumental monitoring method for measurement of asbestos concentrations at point sources or near sources is described. A scanning electron microscope with microprobe capability and an image analyzing system is utilized. Complete details for manual operation have been developed. The feasibility of a fully automated system for determining the amount and size distribution of asbestos fibers in air was established. The preliminary results of the analysis of samples collected at point sources and near point sources are included. (Author abstract modified)

34462 **APTIC NO. 57000**

Pickett, William E., Jr. and Eric B. Sansone

THE EFFECT OF VARYING INLET GEOMETRY ON THE COLLECTION CHARACTERISTICS OF A 10-MILLIMETER NYLON CYCLONE. *Am. Ind. Hyg. Assoc. J., 34(10):421-428, Oct. 1973. 5 refs.*

The theory of aerosol sampling, total dust and respirable dust sampling, sampling flow rates, and test chamber and auxiliary equipment are discussed relating to tests of the effect of varying inlet geometry on collection of aerosols by a 10-millimeter nylon cyclone. Inlet dimensions of the cyclone are such that at a 2 l/min sampling rate, particles of 1-10 micron aerodynamic equivalent diameter (AED) may not be respresentatively sampled. Samples of a coal dust aerosol were collected simultaneously with two filter holders: one designed to sample representatively 1-10 micron AED particles at 2 l/min in calm conditions, and one with smaller inlet dimensions corresponding to those of the 10-millimeter nylon cyclone. No differences in mass concentration or size distribution were observed. Standard 10-millimeter nylon cyclones were modified to conform to theory by installing entries of plexiglas and aluminum. A coal dust aerosol with 3.3 micron geometric mean AED was simultaneously sampled with modified and unmodified cyclones. Differences in the mass concentration of respirable dust collected were observed with the plastic entries and were attributed to m particle deposition within the entry caused by static charge. No differences were observed with the aluminum entry. (Author abstract modified)

34463 **APTIC NO. 57110**

Poletayev, M. I. and V. K. Vinogradov

A PORTABLE AIR-SAMPLING INSTRUMENT FOR CHEMICAL SANITATION TESTS. *(Portativnyy pribor dlya otbora prob vozdukha pri sanitarno-khim- icheskikh issledovaniyakh). Gigiena i Sanit., vol. 38:89-90, 1973. Translated from Russian, 4p.*

The development of a portable air sampling instrument for chemical sanitation tests is described. Modifications and additions were made to the MK-1 minicompressor design. The principal components are the miniature compressor, rotameter, and switch. The technical specifications of the unit are included. The instrument in convenient for work under field conditions. The proposed air sampling technique could be used extensively for various chemical sanitation tests in the institutes, at sanitation and epidemiological field stations, industrial laboratories, and other competent agencies.

34464 **APTIC NO. 57629**

Purdue, Larry J.

A PERFORMANCE EVALUATION OF SO2 MONITORING INSTRUMENTS. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., National Environmental Research Center, 13p., 1973. 6 refs. (Presented at the American Society for Testing and Materials, Symposium on Instrumentation for Monitoring Air Quality, Boulder, Colo., Aug. 14-16, 1973.)*

Monitoring instruments for measuring ambient concentrations of sulfur dioxide are evaluated. The major advantages of using continuous colorimetric analyzers are good sensitivity and specificity. The data collected have good probability of correlating with data collected using the Environmental Protection Agency reference method. The major disadvantages are relatively slow response time, need for frequent periodic maintenance, the use of wet chemical reagents, and the complexity of operation. Coulometric instruments have good sensitivity, minimal maintenance, and simplicity of operation. Selective filters are needed to eliminate the interfering species. Sulfur-containing gases such as hydrogen sulfide and mercaptans produce a positive response comparable to sulfur dioxide when a selective filter is not used. The advantages of flame photometric analyzers are low maintenance, high sensitivity, fast response, and excellent selectivity for S compounds. The major disadvantages are the need for compressed hydrogen or hydrogen generators and the inability to discriminate among S compounds. The conductimetric principle is the least acceptable because of interference by non-SO2 gases.

34465 **APTIC NO. 57405**

Rouillard, E. E. A.

EXPERIMENTAL ERRORS IN SAMPLING DUST LADEN GAS STREAMS; DETERMINATION OF THE PARTICLE CONTENT OF FLOWING GASES, AN ANNOTATED BIBLIOGRAPHY; DETERMINATION OF THE PARTICLE CONTENT OF FLOWING GASES, AN ANNOTATED BIBLIOGRAPHY, 1973 ADDENDUM. *South African Council for Scientific and Industrial Research, Chemical Engineering Group, CSIR Special Report, File 66/51/4510/2, Chem 189 and O/Chem 5, 21p., 120p., and 54p.; Dec. 1971, May 1972, and May 1973. 639 refs.*

The errors resulting from the faulty design and operation of dust sampling equipment are reviewed. Their magnitude depends on the type of sampling equipment as well as on the flow characteristics. Some of the factors contributing to the error are nonrandom under fixed conditions and therefore cannot be eliminated by increasing the number of measurements. A major source of experimental error results from anisokinetic sampling; it is recommended that means of easily maintaining the correct sampling rate be developed. Estimates that the effect of local flow fluctuations are negligible if the sampling time exceeds about 2 hours should be verified. Appended is an estimation of dust retention in a sampling probe. An annotated bibliography containing 620 references presents material pertaining to the determination of the particle content of flowing gases. (Author summary modified)

34466 **APTIC NO. 57135**

Sehmel, G. A.

EVALUATION OF HI-VOLUME CASCADE PARTICLE IMPACTORS. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 22-26, April 1973. 1 ref.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

Commercially available 20 cu ft/min hi-vol cascade particle impactors were evaluated for sampling errors caused by wall losses and by impactor orientation. Particle wall loss increased with both an increase in stage soil collection and an increase in airborne particulate concentration. The particle size distributions obtained with the impactors were biased if the sampler inlet was not directed into the prevailing wind. Particle inertia caused more particles to enter the sampler inlet than were initially in the air drawn through the sampler inlet. This increased particle collection caused airborne particle concentrations to be estimated as greater than actual. Thus, the particle resuspension rates were estimated too high. (Author abstract modified)

34467 **APTIC NO. 57207**

Sheibley, Dean W.

TRACE ELEMENT ANALYSIS OF COAL BY NEUTRON ACTIVATION. *Am. Chem. Soc., Div. Fuel Chem., Preprints, 18(4):59-71, 1973. 2 refs. (Presented at the American Chemical Society, National Meeting, 166th, Chicago, Ill., Aug. 26-31, 1973.)*

Neutron activation analysis was used to analyze the trace element composition of coal, fly ash, and bottom ash. The same techniques could be used to analyze other fuels, air particulates, tissues, and water. The analysis method, data reduction, interference corrections, precision and accuracy, and analysis capability are described. Typical results are given. Fly ash has large concentrations of calcium, cerium, iron, aluminum, barium, potassium, manganese, sodium, rubidium, tin, titanium, thorium, uranium, vanadium, and zirconium. Uranium and thorium are naturally radioactive and alpha emitters. Therefore, for each ton of coal burned, the potential hazard exists of emissing 0.3 curies of alpha-activity based on 1 ppm of uranium in coal. No element had a higher concentration in the bottom ash than in the fly ash. The neutron activation analysis was accurate and reliable. Computerized data reduction reduced the total manpower required to 3.0-3.5 hours per sample. Interference corrections for mercury, selenium, and arsenic are described.

34468 **APTIC NO. 57725**

Simonotti, L.

POLYCYCLIC AROMATIC HYDROCARBONS IN GASOLINE ENGINE EXHAUST GASES: METHOD OF SAMPLING AND ANALYSIS OF INDIVIDUAL HYDROCARBONS. *(Gli idrocarburi aromatici policiclici nei gas di scarico dei motori a benzina). Text in Italian. Riv. Combust. (Milan), 27(9):443-449, Sept. 1973. 16 refs.*

A procedure is proposed for the determination of the more significant polynuclear aromatic hydrocarbons (PNA) in exhaust gases from internal combustion engines. For its simplicity, repeatability and rapidity, the procedure is suitable for routine analysis. By n gas chromatography-mass spectrometry 33 compounds (from naphthalene to coronene) have been identified. The overall amount of material identified corresponds to about 75% of the collected sample. The amount and the composition of PNA recovered from a standard monocylinder engine under conditions favoring soot formation are strongly dependent on the quality of fuel. (Author abstract)

34469 **APTIC NO. 57722**

Smith, K. A. and R. J. Dowdell

GAS CHROMATOGRAPHIC ANALYSIS OF THE SOIL ATMOSPHERE: AUTOMATIC ANALYSIS OF GAS SAMPLES FOR O2, N2, AR, CO2, N2O AND C1-C4 HYDROCARBONS. *J. Chromatographic Sci., 11(12):655-658, Dec. 1973. 17 refs.*

A method is described for the quantitative analysis of gaseous mixtures of nitrogen, oxygen, argon, carbon dioxide, nitrous oxide, and C1-C4 hydrocarbons. Batches of up to 40 samples in syringes are injected by an automatic system. Each sample is split between three parallel columns, two of which are connected to thermal conductivity detectors for the determination of the inorganic gases, and the other to a flame ionization detector, for the determination of hydrocarbons. The latter is one of two identical columns, each of which can be used in turn while the other is automatically backflushed to remove compounds with long retention times. Chromatograms showing the mixtures of hydrocarbons found in soil are included to illustrate the variations in relative and absolute concentrations of each gas which can occur under natural conditions. (Author abstract)

34470 **APTIC NO. 56989**

Sugawara, Toru, Isamu Komatsu, Nobuharu Matsui, and Kazuo Kaburagi

NITROGEN OXIDES ANALYZER FOR STACK GAS. *(Endo haigasu-yo chisso sankabutsu gasu nodokei). Text in Japanese. Hitachi Hyoron, 55(9):19-23, 1973.*

An ozone oxidation and dual-wave photometric gas analyzer, developed by Hitachi, is introduced. This device continuously measures nitrogen oxide contents in stack gas by changing nitric oxide into nitrogen dioxide. The device consists of a sampling system, which eliminated dusts and water in the flue gas, and a flow regulator valve which lets the gas flow at the rate of 1 l/min. From the ozone producer, a set amount of ozone (standard flow 30 ml/min) is supplied and NO and NO2 in the flue gas are converted into dinitrogen pentoxide. This gas gradually decomposes the NO2 even at a normal temperature, but by heating the gas at 300-400 C, NO2 conversion is accelerated. Excess ozone is decomposed by the heat into oxygen, and no secondary pollution will occur. When sulfur dioxide in the flue gas react with ozone and water and become sulfuric acid mist, it will be eliminated in the mist separator. Then the gas goes to the measurement cell, which is dual-wave spectrophotometry. This analyzer is characterized by its simple operation, continuous and accurate measurement, lack of interference by water, carbon dioxide, sulfur dioxide and ammonia gas; the measurement limits are 0-500 ppm, or 0-1000 ppm; the response is quick and 90% response can be obtained in 60 sec. The use of dual-wave length spectrophotometry eliminates the interference of measurement cell window, and maintenance is easy.

34471 **APTIC NO. 57719**

Sugimae, Akiyoshi

EMISSION SPECTROGRAPHIC DETERMINATION OF MERCURY IN THE ATMOSPHERE. *(Hakko bunko bunseki-ho ni yoru taikichu no suigin no teiryo). Text in Japanese. Bunseki Kagaku (Japan Analyst) (Tokyo), 22(10):1350-1356, Oct. 1973. 15 refs.*

Emission spectrography was used to determine mercury in the atmosphere. An activated carbon filter was used to collect mercury vapor. The filtration efficiency was 99.95% for particles whose mean size was 0.6 micron in diameter. However, the filter was inefficient in adsorbing mercury vapor. To increase sorbent efficiency for Hg vapor, the filter was impregnated with iodine. The iodine-impregnated filter adsorbed mercury vapor with an efficiency of 100% at a face velocity of 36 cm/sec. Mercury compounds were collected by drawing air through the filter at a flow rate of 30 l/min for 5-7 days. A high-purity graphite electrode, 6.2 mm in diameter with a cup 12.7 mm in depth and 4.8 mm in diameter, was immersed in a carbon tetrachloride solution of 5% paraffin for a few minutes and dried at 80 C. Sample filter disks were packed in the crater of the electrode. The total charge in the electrode was usually 12 disks. A 200 microliter aliquot of internal standard solution containing 100 micrograms/microliter of arsenic was added dropwise. The electrode was dried for 10-24 hours to remove the water. A boiler cap was placed on the electrode. Standard electrodes were prepared by dropping standard solutions containing known amounts of Hg and 100 micrograms/microliter of arsenic on 12 disks of unused activated carbon filters packed in the electrode. The prepared electrodes were subjected to DC arc excitation. The calibration curve was obtained over a range of 0.0008-0.017 micrograms/cu m air for 7 days. The method with the minimum procedure for the pretreatment of sample was precise and useful for rapid analysis for mercury in the atmosphere with coefficient of variation of 14.8%.

34472 **APTIC NO. 56994**

Tachibana, Keisuke and Tsugitoshi Ogura

SEVERAL EXPERIMENTAL STUDIES OF ANALYTICAL METHOD OF NOX IN FLUE GASES WITH PHENOL DISULFONIC ACID. *(Haigasu-chu no chisso sankabutsu keisokuho ni tsuite, fenoru jisuruhonsan-ho ni taisuru 2,3 no kento). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):259, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 14.)*

As the most reliable method of measuring nitrogen oxides in flue gases, the phenoldisulfonic acid method was selected and examined. Several problems in the colorimetric operation and oxidation of nitric oxide gas are reported here. For stabilizing the nitric ion, addition of 4% sodium hydroxide is required to the point exceeding neutralization. Evaporative dessication must be perfect, and in the colorimetry operation, the liquid color increases when irradiated by the sun. This last can be controlled by keeping the liquid in a brown flask. To shorten the operation, a simplified PDS method was devised by oxidizing NO gas. In the area of NO concentration 80-500 ppm, oxidation of NO can be completed in one hour if 30 ml of oxygen to 200 ml of test gas is used, and in two hours if air is used instead of oxygen. This quick PDS method was found completely reliable and quite satisfactory.

34473 **APTIC NO. 57728**

Tanaka, Yashuhiko, Saburo Obara, Akira Nakamura, Susumu Kajihara, and Tsutomu Yano

CONCENTRATION AND SIZE DISTRIBUTIONS OF AIRBORNE DUST PARTICLES IN A HORIZONTAL DUCT FOLLOWING A VENTURI. *(Benchuri koho no suiheikannai ni okeru fyunjin no nodo bunpu to ryudo bunpu). Text in Japanese. Funtai Kogaku Kenkyu Kaishi (J. Res. Assoc. Powder Technol., Japan), 10(8):555-561, Oct. 1973. 8 refs.*

Measurements were made of the particulate concentration and size distributions in an air-talcum suspension across a horizontal circular duct downstream of a venturi. A cascade impactor was used for the determination of concentrations and size distributions of dust in small samples of the suspension extracted from the duct. The particles, like the air velocity, remained uniformly distributed, except for sampling positions immediately near to the wall of the duct. The venturi was efficient, both to obtain a uniform flow, and also to ensure that a dust sample extracted at a single point, near the center of the duct, should be representative of the whole of the suspension. Thus the venturi facilitates single-point sampling, which is more advantageous than multi-point sampling for ease of operation. The possibility of using the cascade impactor as an aerosol sizing device capable of giving direct size analysis figures of dust in the dry state was presented. (Author abstract)

34474 **APTIC NO. 57580**

Thompson, Glenn D.

COMPARISON OF EXHAUST EMISSION MEASUREMENTS BY THE FEDERAL REGISTER PROCEDURES AND BY A BECKMAN 6800 GAS CHROMATOGRAPH. *Preprint, Office of Air and Water Programs, Ann Arbor, Mich., Emission Control Technology Div., 23p., 1973. 1 ref.*

Measurements of exhaust emission components made with a Beckman Gas Chromatograph Model 6800 were compared to those made with the Standard Federal Register instrumentation. A modified Beckman instrument is capable of measuring total hydrocarbons, methane, carbon monoxide, and carbon dioxide. Since the instrument is designed as an ambient air quality instrument, no sensitivity problems were expected or observed. There were no problems of exceeding the operating range encountered. There were significant differences found for CO and CO2 when comparing bad sample measurements made on the Federal Register instruments and on the Beckman 6800. These variations represent fluctuation of insufficient calibration of one of the instruments, probably the gas chromatograph. Investigation of more thorough calibration and adjustment of the gas chromatograph is recommended if better agreement is desired. (Author summary modified)

34475 **APTIC NO. 56993**

Torii, Kenji

CONTINUOUS AUTOMATIC ANALYSIS OF AMMONIA IN AIR. *(Taiki Anmonia no renzoku jido sokutei). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):261, Oct. 1973. (Presented at the Japan. Society for Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 16.)*

Performances of the Indophenol method of measuring ammonia in the air or flue gas were examined. After absorbing ammonia in sulfuric acid solution, two kinds of reagents were mixed and heated to 65 C, and measured by colorimetry with a 630 mm interference filter. Under those conditions, sensitivity 0.01 ppm, 1 ppm standard liquid absorption, 0.7 unit, and variation coefficient 0.5% CV were obtained. When a 15 mm-long flow cell was changed to 50 mm, the sensitivity was improved to 0.004 ppm. Reaction time was 17 min, and the full scale peak was reached 4 min after that. No interference by sulfur dioxide was noted until the SO2 concentration increased three times over. Minute interference of nitrogen dioxide and formaldehyde were noted.

34476 **APTIC NO. 57321**

Uchiyama, Masahiro, Yoshitaka Shimada, Isao Takahashi, Yuzuru Saito, and Fumiko Hayashi

HALOGEN GAS IN AUTOMOTIVE EXHAUST GASES. *(Jidosha hai gasu-chu no harogen gasu ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):326, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 71.)*

Halogen gases in automotive exhausts, especially hydrogen chloride and hydrogen bromide were investigated by experiments. Samples were taken by a six-sequence automatic air sampler. HCl and HBr ions were quantitated by colorimetry. First nitric acid in solution with both ions was oxidized by potassium permanganate and heating, and the separated bromine ion was eliminated. The remaining chlorine ion was measured by thiocyanide-mercury colorimetry. The bromine ion was measured by oxidizing the solution by sulfuric acid and potassium permanganate, and extracting bromine by carbon tetrachloride. Mercury salt and diphenylcarbazone solution were added and absorption spectometry was applied. The measurements in parking lots and traffic intersections were found relatively low. Thy measurements taken during idling of four types of cars using four types of regular gasolines ranged between 0.12-2.16 ppm of HCl, and 0.19 and 0.75-HBr. These gases are relatively heavy and can create extremely high concentration locally, depending on the weather conditions.

34477 APTIC NO. 57751

Yamate, Noboru, Toshiro Matsumura, and Akira Inoue

CONTINUOUS MEASUREMENT OF CARBON MONOXIDE IN AMBIENT AIR USING ELECTROCHEMICAL METHOD. *(Erekutoro-kemicaru hoshiki ni yoru taikichu no issanka tanso no renzoku sokutei ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):265, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 20.)*

Various tests were given to an electrochemical method environmental carbon monoxide automatic meter. The meter has 0-100 ppm calibration, is small and light (3.7 kg), operates on alternate and direct currents, and has a suction pump, a flow control orifice, a heater, a filter, a censor, amplifier circuit, and an indicator, and a recorder. The reliability, calibration, response time are all good, the effects of carbon dioxide and water were none, and the measurements agreed well with the results taken by infrared absorption spectrometry. The advantage of this automatic meter is its light weight and portability.

34478 APTIC NO. 57200

Zak, B. D., R. D. McLaughlin, D. A. Church, and T. Hadeishi

THE IZAA SPECTROMETER: A DETECTOR FOR TRACE ELEMENTS IN GAS, LIQUIDS, AND SOLIDS. *Am. Chem. Soc., Div. Environ, Chem., Prepr., 13(2):52-57, Aug. 1973. (Presented at the American Chemical Society, National Meeting, 166th, Chicago, Ill., Aug. 26-31, 1973.)*

The isotope-Zeeman atomic absorption (IZAA) spectrophotometer is described. It was used to determine mercury, lead, cadmium, and other trace elements in ambient air, stack gases, and vehicle exhausts. The IZAA method is compared to several other conventional methods.

34479 APTIC NO. 57645

Little, (Arthur D.) Inc., Cambridge, Mass.

CHEMICAL ANALYSIS OF ODOR COMPONENTS IN DIESEL EXHAUST (FINAL REPORT) Coordinating Research Council and U. S. Environmental Protection Agency Contract 68-02-0561, CRC Proj. CAPE-7-68, Rept. ADL 74744-5, 89p., Sept. 1973. 5 refs.

An instrumental method for measurement of the odor intensity of diesel exhaust is described. Diesel exhaust odor consists of oily-kerosene and smoky-burned odor groups. The odor intensity is a logarithmic function of the concentration of the oxyenate fraction in the exhaust. The instrumentation method can be applied to studies on methods of decreasing exhaust odor levels and is based on analytical liquid chromatography (ALC) using an ultraviolet detector for measurement of the odorous fractions. The final correlation between diesel exhaust odor intensity and the oxygenate exhaust fraction abundance was developed. New analytical size sample collection traps were designed to be compatible with the ALC instrument sample size requirements and allow the collection of sufficient sample for analysis in 1-5 min, depending on the odor level. Collected samples of exhaust are stable for about 12 days. (Author summary modified)

1972

34480 APTIC NO. 57290

Aleksandrov, E. L., A. F. Kovalev, K. B. Yudin, and N. P. Yasevich

INSTRUMENTS FOR AEROSOL MEASUREMENT. *(Kompleks priborov dlya aerozol nykh izmereniy). Text in Russian. Inst. Eksp. Meteorol., 2(36):96-120, 1972. 18 refs.*

A complete set of instruments, suitable for the measurement of different aerosol parameters at ground stations and in observation towers up to an altitude of 300 m, is described. The automatic recording instruments can be integrated within a computerized data processing system. The concentration and particle size distribution of atmospheric aerosol particles is measured in a range of radii from 0.4 to 22.5 micron and for concentrations of up to 1000 particles per cu m by means of a photoelectric counter with non-linear amplifier and converter. The atmospheric light scattering coefficent at a wave length of about 400 nanom and within a range of 0.00005 to 0.01/m, corresponding to visibility measurements in a range of 100 km to 500 m, is measured by means of nephelometer. The condensation nuclei concentration is measured in a range of 2000 to 25,000 nuclei per cu m. The weight concentration of dry aerosol particles, averaged for 2 to 3 hr is measured by the gravimetric method, using filter material, the error being + or 20%, and the minimum concentration being 10 micron/cu m.

34481 APTIC NO. 57518

Haisch, Udo

TRACE DETERMINATIONS IN EMISSION SPECTROCHEMICAL ANALYSIS. *(Zur Spurenbestimmung in der Emissionsspektralanalyse). Text in German. Fresenius Z. Anal. Chem., 259(1):1-6, 1972. 9 refs.*

The effect of the spectrometer slit width on the calibration curve and the limit of detection in spectrochemical analysis with photoelectric measuring devices was studied for the simultaneous measurement of line and underground intensity of trace elements. The influence of different shapes of the analytical line was considered. The detection limit was discussed for cases of a constant noise level, a noise level determined by the photon noise, and a noise level produced by statistical effects in the photomultiplier. Equations were derived for calculating the noise level in photometric analysis.

34482 APTIC NO. 57536

Kavan, Ivo

DETERMINATION OF ODORANTS PRESENT IN GAS. *(Stanoveni odorantu v plynu). Text in Czech. Ustav pro Vyzkum a Vyuziti Paliv, Prague (Czechoslovakia), Sb. Prednasek 50 (Padesatemu) Vyroci Ustavu Vyzk. Vyusiti Paliv, 1972, p. 162-170.*

Gas chromatography with a flame ionization detector was used to determine odorants present in natural gas and town gas. Tetrahydrothiophene was determined at 120 C with Apiezon L, diethyl sulfide at 100 C on a column with polyethylene glycol adipate, and dimethyl sulfide on a column with 1,2,3-tris(2-cyanoethoxy) propane. Concentrations of odorants in 10s of mg/cu m of gas were determined with a relative error of about 5%. Purity of substances used for gas odorization was 100 C on a column with polyethylene glycol 1500. The thermoionization detector was used to find the following sulfur compounds in light petroleum from the Rectisol plant: hydrogen sulfide, carbon disulfide, methane and ethanethiol, dimethyl and diethyl sulfide, thiophene, and methylthiophenes.

34483 APTIC NO. 57670

Kessenikh, A. V., L. N. Drozdov-Tikhomirov, and L. A. Belorusskii

NMR STRUCTURAL ANALYSIS OF ORGANIC MOLECULES IN TERMS OF THE THEORY OF SPECTRAL MOMENTS AND PROBLEM SOLUTION BY

METHODS OF IMAGE RECOGNITION THEORY. (Zadacha strukturnogo analiza organicheskikh molekul po spektram yamr v terminakh teorii momentov i yeye reshenie metodami teorii raspoznavaniya obrazov). Text in Russian. Izv. Acad. Nauk SSSR, Ser. Khim., no. 1:95-98, 1972. 8 refs.

By making use of summation of spectral moments of isolated line multiplets in NMR (nuclear magnetic resonance) spectra of and conversion of the observed typical paramagnetic resonance (PMR) spectra of aromatic compounds on the scale of 0.2 Hz/mm, a general approach was made to structural classification of substances according to their PMR spectra. The program was successfully used for the disubstituted benzenes, and of the 50 examples tested only one produced an identification error.

34484 APTIC NO. 57397

Kothny, E. L. and P. K. Mueller

THE ANALYSIS OF OXIDANTS IN THE ATMOSPHERE. AIHL REPORT NO. 121. *Preprint, 11p., March 1972. 33 refs. (Presented at the Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, 23rd, Cleveland, Ohio, March 6-10, 1972.)*

A review is presented of methods for analysis of oxidants in the atmosphere and those techniques currently being employed by the State of California Department of Public Health. Three sampling methods being used by the Department are: short term manual, continuously recording, and integrated 24-hour sampling. Manual methods are used for calibrating continuous instruments both in the laboratory and in the field. Continuous recording instruments are utilized widely for monitoring. The manual 1% potassium iodide (n-1% KI) method is used with dilute mixtures of ozone in air for dynamic calibration of other instruments or methods because one mole of ozone generates one mole of iodine quantitatively. Alkaline KI is considered more convenient than the phosphate buffered neutral KI method, but the reagents degrade significantly after the first hour of collection. Some inorganic substances have been considered as possible means for colorimetric 24-hour sampling, and chromium-catalyzed manganous pyrophosphate appears promising with respect to sensitivity, specificity, and resistance to oxidation. Continuous methods in California have been based mainly on spectrophotometry of the iodine color liberated by n-KI; the chemiluminescence principle is currently favored because of specificity toward ozone. Long path spectrophotometry can sense the strong absorption of ozone in the 250/260 nm region or at 1056 cm to the minus 1, and two versions currently available are the double-beam correlation spectrometer and the second derivative spectrometer. Interference-free performance in urban air remains to be demonstrated. None of the newer and more promising methods have been sufficiently proven in field studies to establish equivalence with the currently standardized KI procedures.

34485 APTIC NO. 57341

Renoux, Andre and Georges Tymen

BEHAVIOR OF AEROSOLS IN MARITIME ATMOSPHERE. *(Comportement des aerosols de l air en amotsphere maritime). Text in French. Bull. Soc. Sci. Bretagne, vol. 47:141-159, 1972. 18 refs.*

The granulometric distribution and weight concentration, as well as the radioactivity of aerosols sampled by means of Schneider-Poelman filters, nuclepore filters, and cascade impactors in a maritime atmosphere in Brest were studied. Methodological problems of granulometric studies by the use of cascade impactors are discussed. The aerosol concentrations were found to be highest during periods of winds from the continent, and lowest during winds from the sea. The weight concentration averaged 110 micrograms/cu m, which corresponds to the theoretical expectation on the basis of an assumed relationship between the weight concentration and the size of the urban agglomeration in terms of population. Particles smaller than 1.3 micron in diameter made up 20% of the total weight, while particles smaller than 2.7 micron and 18 micron accounted for 50 and 70% of the total weight, respectively.

1971

34486 APTIC NO. 57470

Breuer, Hans

PROBLEMS OF GRAVIMETRIC DUST SAMPLING. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 2:1031-1043, 1971. 16 refs. (Sept. 14-23.)*

Gravimetric dust sampling to separate dusts into coarse and fine fractions is replacing previous short-term dust samplers. Since gravimetric devices give an integrated sampling covering several hours, important information about changes in the dust concentration during this time is lost. Gravimetric sampling should therefore be supplemented by measurements with simple, direct-reading dust samplers. The design of the gravimetric sampler vT/BF 50 was based on these considerations. This sampler separates the airborne dust according to the deposition of dust particles in the lungs, that is, into coarse and fine dusts by two successive cyclones. Comparative measurements with different dust samplers showed the influence of the fineness of the dust on the results. (Author summary modified)

34487 APTIC NO. 57471

Coenen, W.

CALCULATION OF CONVERSION FACTORS FOR VARIOUS FINE DUST SEPARATION PROCESSES. *(Berechnung von Umrechnungsfaktoren fuer verschiedene Feinstaubmessverfahren). Text in German. British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 2:1045-1051, 1971. 7 refs. (Sept. 14-23.)*

In methods for measuring siliceous dust, the whole collected quantity is separated into two parts, one of which is approximately the respirable part. The separation follows a function of particle size, which is specific for the measuring method. The measured dust concentration therefore depends on the separation function. For the comparison of concentrations measured with different separation functions, known conversion factors are required. A method of calculating those conversion factors is developed. Particle size distributions, as found in the surface industry, are represented by analytical functions. The conversion factors are obtained by applying the different separation functions to those particle size distributions. The geometric mean conversion factors and their 95% confidence limits are given for five measuring methods with different separation functions.

34488 APTIC NO. 57628

Edelberg, Seymour

SOME CONSIDERATIONS IN THE USE OF REMOTE ENVIRONMENTAL MONITORING. *In: Man s Impact on the Climate. William H. Matthews, William W. Kellogg, and G. D. Robinson (eds.), Cambridge, Mass., MIT Press, 1971, Chapt. 42, p. 482-501. 38 refs.*

New techniques which could be used to monitor global or regional changes in certain atmospheric gases and aerosols, vertical temperature distributions, and cloud characteristics are discussed. The measurements could involve ground based, airborne, or satellite platforms with active or passive instruments operating in the visible, infrared, or microwave portions of the electromagnetic spectrum. Carbon monoxide is monitored with an instrument which, looking down, senses the solar radiation which passes down through the atmosphere, is reflected by the earth, and then passes up through the attenuating atmosphere. Other gases can be monitored using a gas filter correlation analyzer, absorption spectroscopy, or laser radar backscatter measurements. Gas temperature distributions are obtained using the earth-limb (occultation) mode, a CO2 molecule with an initial rotational quantum of about 56, or various inversion techniques. Aerosol monitoring requires the measurement of the absorbing and scattering properties of the particles, as well as the particle size distributions and concentrations, and the chemical nature of the aerosol. Doppler processing and Raman backscatter will yield the backscattered return from the aerosol particles. Other methods are described for obtaining more detailed absorption and diffuse scattering data to air in understanding albedo and energy transfer changes, and the use of lasers for atmospheric sensing is discussed. Cloud height can be measured using a downward looking short pulse laser radar. The absorptive and scattering properties of clouds could be obtained using the technique applied by Robinson (1962, 1966) to aerosol layers. The emissive properties of clouds in the infrared region can be obtained by quantitative multicolor radiometry and the total water content in clouds can be measured by means of microwave radiometry.

34489 **APTIC NO. 57310**

Erley, D. S.

INFRARED ABSORPTION SPECTROSCOPY. *Am. Ind. Hyg. Assoc. J., 32(6):412-414, June 1971. 6 refs.*

The analysis of solids and liquids by infrared absorption spectroscopy is a well known field. Less common and of more direct concern to the industrial hygienist is the use of infrared to analyze gases and vapors, specifically the analysis of air for trace contaminants (100 ppm or less). Because oxygen and nitrogen are transparent to infrared radiation, multiple reflection sampling cells with path lengths from 10-40 m are utilized to achieve high sensitivity to many atmospheric contaminants. Sensitivities of a variety of gases and vapors including hydrocarbons, halogenated hydrocarbons, nitrogen oxides, sulfur dioxide, and carbon monoxide (in expired air) to a 10-meter path length cell at atmospheric pressure are listed. Included are the analytical wavelengths and 1970 threshold limit values. Many compounds can be similarly determined in the breath of workers following exposure to pollutants.

34490 **APTIC NO. 57522**

Hearn, John R.

AN ENGINEER S VIEW OF AIR POLLUTION MEASUREMENTS AND THE POTENTIAL OF MICROWAVE SPECTROSCOPY. *Preprint, Inst. of Electrical and Electronics Engineers, New York, and Western Electronics Manufacturer s Assoc., San Francisco, Calif., 8p., 1971. 8 refs. (Presented at the Western Electronic Show and Convention, San Francisco, Calif., Aug. 24-27, 1971, Paper 32/4.)*

Microwave spectroscopic instruments using changes in molecular rotational energy states are discussed for analysis of sulfur dioxide, methyl mercaptan, ethyl mercaptan, mixtures of sulfur compounds, formaldehyde, acrolein, propionaldehyde, methanol, and aldehyde mixtures, and spectra are shown. Since the method is sensitive to moments of inertia, the spectra can differ drastically between two chemically identical molecules if their isotopes differ. By making a single measurement of the absolute pressure by means of an accurate pressure gauge, the system is calibrated. Sulfur dioxide readings at the few ppm level without any concentration of the sample were possible with the spectrometer. Cataloguing only two or three spectrum lines may be necessary to identify a component of a fairly complex mixture, or a computer could be used to correlate the most significant peaks with a catalogue of spectral line frequencies for various compounds.

34491 **APTIC NO. 57464**

Rendall, R. E. G. and G. C. H. van Sittert

THE DETERMINATION OF THE SIZE DISTRIBUTION OF MINE DUSTS USING THE COULTER COUNTER. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 2:801-809, 1971. 8 refs. (Sept. 14-23.)*

Various features of the Coulter counter as a means of sizing airborne dust are discussed. Experiments were carried out to determine the relationships between size distributions as determined by the Coulter counter and sedimentation using a thermal precipitator. The results were in the same form, but the far greater count and objective sizing gave greater confidence in the Coulter plot. The Coulter was used to calculate specific surface of small quantities of respirable mine dust by conducting a size distribution analysis on a known weight of dust and by applying shape factors to the measured particle volumes. The Coulter results were more closely related to gas permeability results than B.E.T. results since both methods measured exterior surface only and ignored internal pore structure. A further application of the counter in the determination of the sampling characteristics of size-selecting gravimetric instruments is described. Thus, within the range 0.7-12 micron, the Coulter counter is sufficiently accurate for normal dust sizing work. Its main advantages are its objectivity and the reproducibility of its results rather than its speed of operation.

34492 **APTIC NO. 57623**

Thompson, C. R., L. V. Cralley, L. V. Haff, A. W. Hook, E. J. Schneider, J. D. Strauther, and L. H. Weinstein

TENTATIVE METHOD OF ANALYSIS FOR FREE CHLORINE CONTENT OF THE ATMOSPHERE (METHYL ORANGE METHOD). *Health Lab. Sci., 8(1):53-55, Jan. 1971. 5 refs.*

Near a pH of 3.0, the color of a methyl orange solution ceases to vary with acidity. The dye is quantitatively bleached by free chlorine, and the extent of bleaching can be determined colorimetrically. The optimum concentration range is 0.05-1.0 ppm in ambient air (145 micrograms to 2900 micrograms/cu m at 25 C and 760 torr). Sources of interference include bromine, manganese, sulfur dioxide, nitrogen dioxide, and nitrites. Chlorine concentrations were spectrophotometrically measured by this procedure with an average error of less than + or 5% of the amount present. The procedure, reagents, calculations and means of calibration are described.

1970

34493 **APTIC NO. 57408**

Gnyp, A. W., S. J. W. Price, C. C. St. Pierre, and J. Steiner

AN INFORMATION SEARCH AND AN EVALUATION OF FACTORS AFFECTING STACK SAMPLING. *Preprint, Industrial Research Inst., Windsor Univ. (Canada), 136p., Sept. 1970. 97 refs.*

A comprehensive search of all available information on stack sampling was carried out by contacting 865 universities, institutes, process industries, government agencies, pollution control equipment manufacturers, testing laboratories, and consultants, in North America and Europe. The computerized literature survey covering 1710 pertinent references provides a bibliography, author index, keyword index, and a frequency count listing of the keywords. A critical comparison of 45 presently acceptable and independent stack sampling procedures served as a basis for the analysis of factors affecting the accuracy of stack sampling. By selecting the most desirable features from these stack testing procedures, it was possible to prepare the first draft of a potential Provincial Test Code for Determining Particulate Concentrations in Confined Gas Streams. Future work will be concerned with the revision and expansion of the proposed Test Code and the continuous updating of the computerized library as more information is received and analyzed. (Author abstract)

34494 **APTIC NO. 57607**

Pagni, Patrick J.

LASER AEROSOL MONITOR) *California Univ., Berkeley, Dept. of Mechanical Engineering, National Science Foundation Grant GK-27895, Proj. UCB-Eng-3204, Proposal P1K0946, 24p., Dec. 1970. 68 refs.*

A proposed technique for monitoring atmospheric aerosol size distribution and concentration using continuous time measurements of monochromatic transmitted energy is described. Intensity attenuation due to transmission through an aerosol is determined by the particle size integral over the product of the particle size distribution with the size dependent scattering cross section. A power law size distribution, n(r) equals cr to the minus b, is assumed. Measurement of transmitted intensity at two wavelengths provides a direct measure of the two parameter aerosol size distribution. This preliminary analysis neglects absorption, forward scattering, and multiple scattering. The poly-disperse aerosol is assumed to consist of spherical, homogeneous, dielectric particles with a real index of refraction, n equals 1.5. The scattering cross section is calculated using the Rayleigh approximation for alpha equals 2 pi r/lambda less than 1 and a modified Smart and Vand approximation to the Mie theory for alpha greater than 1. Using this approximate scattering cross section, a closed form aerosol extinction coefficient is obtained. The proposed aerosol monitor will be examined by theoretical analysis, lab and field studies, and prototype development. It will be simple, inexpensive, and easily standardized. (Author abstract modified)

34495 **APTIC NO. 57356**

Pines, I.

METHODS FOR DETERMINING LEAD IN THE ATMOSPHERE. *Air Conserv. (English translation from Polish of: Ochrona Powietrza), 4(6)(20):21-26, 1970. 5 refs.*

NTIS: TT 70-55124/6

A comparison of two dithizone photometric methods for the determination of lead in the atmosphere is presented. The basic differences between the two methods are: mineralization is performed by the wet technique under one method (method I) and the dry technique under the other (method II). Concentration ranges for method I and II, respectively, are 1-10 micrograms Pb and 1-500 micrograms Pb. Two extractions are applied under method I for the removal of lead and excess dithizone, while a single extraction at pH 11-11.5 is sufficient in the second method; dithizone easily decomposes in method I and may require purification, while in the second method the chloroform layer containing products of dithizone oxidation is discarded to allow for a pure water layer of dithizone. Method II uses 10 times less potassium cyanide (a highly toxic substance) than method I. Finally, method II is less time-absorbing and more appropriate for analyses on a mass scale, although there may frequently occur deviations from the law of proportion at higher absorptions in relation to the photometer used.

34496 **APTIC NO. 57353**

Rai, V. C.

RAPID DETERMINATION OF AMMONIA IN GASES. *Technol. (Sindri), 7(4):327-329, 1970. 18 refs.*

A simple method for rapid estimation of ammonia in gaseous samples based on absorption of ammonia in acidic solutions is presented. The method requires a burette, a levelling bottle, rubber-tubings, and a gas syringe for sampling. The system is filled with an acidic solution (5% hydrochloric acid); the liquid level in the levelling bottle adjusted just above the stopcock of the burette; and the stopcock is then closed. The gas syringe is dried and repeatedly flushed with the gas sample. An accurately measured sample of gas (20 ml) is then slowly injected into the burette through the rubber septum; and as the gas bubbles rise in the burette, ammonia is absorbed by the acidic solution and unabsorbed gas collects at the top. The levelling bottle is lowered till the liquid level in the bottle coincides with the level in the burette. The liquid level in the burette plus the volume of unmarked bur previously calibrated portion gives the volume of ammonia-free gas; and assuming complete absorption of ammonia in the liquid, the ammonia content of the original gas sample is easily calculated. The validity and accurary of the method were tested by comparing the results with titration results; plots of the data on a linear graph showed very close agreement. Deviation from the titration values was within plus or minus 0.5%.

34497 **APTIC NO. 57621**

Tabor, E. C., M. M. Braverman, H. E. Bumstead, A. Carotti, H. M. Donaldson, L. Dubois, and R. E. Kupel

TENTATIVE METHOD OF ANALYSIS FOR MANGANESE CONTENT OF ATMOSPHERIC PARTICULATE MATTER. *Health Lab. Sci., 7(3):146-148, July 1970. 6 refs.*

Manganese may be present in atmospheric particulate matter in the range 0.01-3.0 microgram/cu m. To estimate microquantities of Mn, the periodate method is one of the most suitable wet chemical methods. The collected Mn is dissolved in nitric and sulfuric acids and the resulting acid solution, free of chlorides, is oxidized with potassium periodate to convert the Mn to permanganate. The latter is determined in a spectrophotometer at 525 nm. A sample or an aliquot representing 20 cu m of air will contain sufficient Mn for analysis if the air contains a minimum of 3.0 microgram/cu m. The maximum amounts of interfering elements which can be present in the sample without significantly altering the results are given. On the basis of mg/cu m, an error of + or 7.7% was reported by the American Conference of Governmental Industrial Hygienists. The reagents, procedures, calibrations, and calculations used are described.

1969

34498 **APTIC NO. 57257**

Hampl, V. and Z. Pelzbauer

ANALYTICAL METHODS FOR DETERMINATION OF AEROSOLS BY MEANS OF MEMBRANE ULTRA-FILTERS. XIV QUANTITATIVE EVALUATION OF THE INNER MORPHOLOGY OF MEMBRANE ULTRAFILTERS BY MEANS OF ELECTRON MICROSCOPY. *Collection Czech. Chem. Commun. (Prague), 34(1):185-193, Jan. 1969. 24 refs.*

The filtration properties of nitrocellulose membrane filters were studied by the method of ultrathin sections. Pore size and distribution were stereometrically determined. Evidence of an anisotropy of filter structure indicates that pores are elongated in the direction parallel to the filtration surface. Dispersion characteristics calculated for the cross section in perpendicular direction are subject to a deformation error of only 4%. The ultrathin sections method confirms the structural difference between the upper and lower filtration surfaces. The thin layer of the upper surface contains round pores. The shape and character of the lower surface are identical with the inner structure. Filters having small pores are characterized by a well-developed surface film. The porosity and mean pore radius of all filters studied show a linear growth from the upper to the lower filtration surface. It follows that a model having conus-shaped capillaries would correspond more precisely to real filter structure.

34499 **APTIC NO. 57194**

Meissel, Gerhard, H. E.

NEW AERIAL PHOTOGRAPHY LOCATES WATER AND AIR POLLUTION. *(Neue Flugfotografie stellt Wasser- und Luftverunreinigungen fest). Text in German. Wasser Luft Betrieb, 13(1):25, Jan. 1969.*

A brief report is given on air pollution and countermeasures in Sweden. A maximum allowable concentration of 0.5% sulfur in heating oils became effective June 1, 1968. Legislative measures to reduce the lead content of gasoline are under way. Measurements of the mercury content of snow disclosed the presence of 20 tons of Hg in Sweden s air space. Primary sources of Hg contaminants are potassium chloride plants. Their liquid and gaseous wastes will be required to undergo purification shortly. The underlying principle of the aerial photographic method is to excite fluorescence of the substance of interest by radiating appropriate wavelengths from the aircraft and recording the phenomenon photographically.

34500 **APTIC NO. 57193**

Mercer, T. T. and R. G. Stafford

IMPACTION FROM ROUND JETS. *Ann. Occupational Hyg., 12(1):41-48, Jan. 1969. 9 refs.*

The efficiency with which particles are collected by impaction from a round jet of diameter, W, onto a collecting plate at a distance S from the jet orifice has been measured as a function of the particle Stokes number for values of S/W between 0.5 and 10.0. The Stokes number corresponding to a collection efficiency of 0.5 varied between 0.17 and 0.24 for values of S/W up to 8.0. Silicone coating on the collecting slide clearly serves as a cushion rather than as an adhesive. Reentrainment of the particles does not occur, possibly because of their small size and the sparseness of the deposit, which permits each particle to be in direct contact with the collecting plate. (Author abstract modified)

34501 **APTIC NO. 57276**

Pueschel, Rudolf F.

THERMAL DECOMPOSITION OF SODIUM-CONTAINING PARTICLES IN A FLAME. *J. Colloid Interface Sci., 30(1):120-127, May 1969. 12 refs.*

The release of sodium atoms from compounds such as sodium bromide, sodium iodide, sodium bicarbonate, sodium chloride, and sodium sulfate, the latter two being of practical significance to air chemistry because of their abundant production by natural (ocean) and man-made (paper pulping process) sources, was studied with a newly developed flame scintillation spectrophotometer in an effort to show what information about particles can be achieved by studying the light pulses emitted from a flame. The intensity of the sodium light emitted from particulate matter subjected to a temperature of 3000 K was proportional to the surface area of the particles for NaCl, NaBr, and NaI for sizes greater than or equal to 0.04 micron in diameter and for Na2SO4 and NaHCO3 of sizes greater than 0.1 micron in diameter. The amount of sodium measured for the halides agreed well with calculations based on surface energies of the crystals and on dissociation energies of the molecules; these energies were about a factor of four to eight less for sodium sulfate and sodium bicarbonate than for sodium chloride, depending on the size of the particles. The method appeared sensitive enough to qualitatively and quantitatively detect single sodium particles as small as 0.05 micron in diameter, although only quantitative information regarding the total number concentration within a certain size interval is generally attainable. Hence, only in situations where one specific compound predominates will the method yield unique information regarding both number concentration and size distribution of an aerosol. An indication of possible decomposition of sodiun sulfate to sodium oxide and sulfur trioxide may be of significance in the atmosphere but cannot be evaluated at this point.

1968

34502 **APTIC NO. 57596**

Fetzer, Laurice E. Jr.

IMPROVED RE-IGNITION TECHNIQUE FOR FLAME PHOTOMETRIC DETECTORS. *Bull. Environ. Contamination Toxicol., 3(4):227-228, 1968. 1 ref.*

One of the problems encountered when operating a flame photometric detector for determining the presence of phosphorus and sulfur compounds in a gas stream is the ease with which the hydrogen rich flame is extinguished by the solvent as it passes from the column to the detector. The following technique was developed for re-ignition of the flame. Five microliters of n-hexane was injected into the instrument, and after waiting 5 sec, the igniter button was pressed and held down until the solvent passed through the detector and the flame automatically re-ignited. The experiment was repeated using several chemicals. In all cases the flame re-ignited smoothly and it was never necessary to shut off the hydrogen flow as in the original procedure. The igniter button must be held down until re-ignition is complete. This normally occurs within 20 sec after injection, at which time the pen has returned to the baseline and the instrument is capable of detecting any phosphorus or sulfur compounds which emerge from the column.

34503 **APTIC NO. 57382**

Rakowski, Robert F.

DEVELOPMENT OF A COLORIMETRIC PERSONAL DOSIMETER FOR NITROGEN DIOXIDE. (FINAL REPORT). *Air Force Systems Command, Wright- Patterson Air Force Base, Ohio, Aerospace Medical Research Labs., Proj. 6302, Task 630203, AMRL-TR-68-104, 15p., Dec. 1968. 18 refs.*

The testing of candidate color reactions for nitrogen dioxide and the development of a prototype dosimeter badge and strip holder are discussed. The device is simple and is capable of warning a person of a hazardous concentration of NO2 vapor. Detector strips are prepared by dipping Eastman Chromagram Sheet, Type K301R2, in a solution of diphenylamine and oxalic acid in methanol. When dry, the strips can be used to estimate the concentration-time product to which an individual has been exposed. Nitrogen dioxide develops a green color while other oxidizers develop a blue color. The strips are heat and light sensitive, are not affected by moisture, and have a shelf life greater than one year. Color standards for concentration-time products of 50, 100 and 300 ppm-minutes and a blue standard to indicate an expired strip are described. It is suggested that the dosimeter badge be tested in the field in actural use and that an independent evaluation of the strip performance be made. Diphenylamine, diphenylbenzidine and o-tolidine should be considered for use in a dosimeter badge for halogenated oxidizers.

34504 **APTIC NO. 57568**

Spurny, K. and J. P. Lodge

ANALYTICAL METHODS FOR DETERMINATION OF AEROSOLS BY MEANS OF MEMBRANE ULTRAFILTERS. XIII. AEROSOL SAMPLING AND AEROSOL MEASUREMENT BY MEANS OF NUCLEAR PORE FILTERS. *Collection Czech. Chem. Commun. (Prague), vol. 33:4385-4389, 1968. 8 refs.*

Aerosol sampling with nuclear pore filters (NPF) is almost the same as with other analytical filters. The aerosol concentration can be evaluated in several different ways. The material of NPF is nonhygroscopic, and its weight is very constant. Using a microbalance, 10 micrograms of aerosol particles can be weighed with 20% accuracy. Since the filters are transparent, small amounts of aerosol particles may be detected with optical density measurements. The clogging of NPF is a function of aerosol concentration. After calibration, it is possible to determine the aerosol concentration by measuring the pressure drop after a known time interval, or by measuring the time necessary to receive a fixed pressure drop increase. Because of the filter transparency, it is easy to count the number of particles on a NPF and evaluate the aerosol concentration. Electron microscopy is the best method for this purpose. The good chemical resistance of these filters allows them to be used for microchemical analysis of aerosols by such methods as colorimetry, chromatography, infrared spectrometry, and neutron activation. The NPFs with pore size of about 0.4 millimicron are suitable for the sampling and counting of ice nuclei in the atmosphere. Tables and graphs are included which show the results obtained using these filters.

34505 **APTIC NO. 57578**

Spurny, K. and J. P. Lodge, Jr.

ANALYTICAL METHODS FOR DETERMINATION OF AEROSOLS BY MEANS OF MEMBRANE ULTRAFILTERS. XII. FILTRATION MECHANISMS OF PORE FILTERS STUDIED BY MEANS OF ELECTRON MICROSCOPY. *Collection Czech. Chem. Commun. (Prague), vol. 33:3931-3938, 1968. 6 refs.*

A qualitative verification was found for three partial filtration mechanisms: the impaction on the filter surface around the pores, the diffusion separation on the inside walls of the pores, and the direct interception. The filtration process was studied using membrane filters with pore size of 0.3 micron, nuclear pore filters with pore size 0.8 micron, and condensation model aerosols. The filters were studied using electron microscopy. During the filtration process, the larger particles were precipitated by impaction on the filter surface and the smaller particles passed into the capillaries where they precipitated mainly by diffusion towards the inner walls of the capillaries. The direct interception mechanism postulates that particles are not material points but have finite dimensions. Electron micrographs also showed that small particles diffuse from the gas stream to the filter surface. Partial filtration mechanisms do exist, and it is possible to vary the influence of each one by changing the gas flow velocity.

34506 **APTIC NO. 57582**

UNIVERSAL GAS ANALYZER. *Anal. Chem., 40(3):155A, March 1968.*

This gas analyzer will eventually be used for the detection of many gases. It now detects and records sulfur dioxide. The measuring principle of the analyzer is based on the photometric determination of a colorimetric reaction. A known amount of reagent is applied on a filter tape using a precision metering pump. The gas to be measured is then drawn through the filter tape where a reaction takes place. After full color development, the optical density of the filter tape is measured and recorded. One complete determination for a gas will take 4 min. The instrument is a modular system so that either the gas analyzer or the recorder may be used alone.

1967

34507 **APTIC NO. 57225**

White, R. A.

ATOMIC ABSORPTION METHOD FOR THE MEASUREMENT OF METAL FUMES. *J. Sci. Instr., 44(9):678-680, Sept. 1967. 3 refs.*

An instrument is described for the immediate measurement of metal fume concentration based on an application of the atomic absorption method. The basic components of this system are a source of resonance radiation, a flame, a monochromator, and a photometer. The absorption by metallic atoms of light energy at specific wavelengths is directly proportional to the number of ground-state, atoms in the light path, and hence to their concentration. Design, construction, and calibration of the instrument are described. It has been successfully used in studies of lead and cadmium fumes under both laboratory and industrial conditions.

1963

34508 **APTIC NO. 571[illegible]**

Pate, John B., James P. Lodge, Jr., and Michael P. Neary

THE USE OF IMPREGNATED FILTERS TO COLLECT TRACES OF GASES IN THE ATMOSPHERE. II. COLLECTION OF SULFUR DIOXIDE ON MEMBRANE FILTERS. *Anal. Chim. Acta, vol. 28:341-348, 1963. 4 refs.*

Assorted types of filters were impregnated with sodium bicarbonate, potassium bicarbonate, or sodium tetrachloromercurate and tested for their capacity to collect known concentrations of sulfur dioxide. Sodium bicarbonate affected the collection efficiency of VM filters. It did not change the permeability of HA and AA filters. The collection efficiency of filters impregnated with potassium bicarbonate was calculated as 95%, and that of sodium tetrachloromercurate-impregnated filters was less than 10%. Results indicate that while collection efficiency decreases significantly before theoretical capacity is approached, the usable capacity is sufficient to sample a 10 ppm concentration for over an hour without an appreciable decrease in efficiency. Experimental data confirmed the assumption that collection takes place on the surface of the impregnant.

1959

34509 **APTIC NO. 57195**

McKee, Herbert C. and William L. Rollwitz

IMPROVED TITRILOG SENSITIVITY. PART II. FIELD PERFORMANCE AND EVALUATION. *J. Air Pollution Control Assoc., 8(4):338-340, Feb. 1959. 1 ref.*

Since sulfur dioxide was considered to be the best single indicator of overall air-pollution levels in Houston, a Titrilog was modified for actual field use in recording the variation in the SO2 concentrations in different sections of the city. Increasing the instrument's sensitivity by a factor of 10 introduced noise and drift problems, the first of which was corrected by reducing the bandwidth of the input circuit with a simple BC low-pass filter. To correct the drift, the zero-suppression of the Titrilog was adjusted so that pure air on the reading was 20 to 30. In actual operation, drift of the zero point beyond the lower end of the scale was the most serious difficulty, and the instrument was set to record a zero reading once an hour. For field use, the Titrilog was installed in a small trailer readily moved to wherever 110-v power was available. The instrument required a minimum of maintenance. Inspection can be limited to twice a week.

34510 **APTIC NO. 57585**

Haagen-Smit, A. J., Vincent [illegible]ylor, and Margaret F. Brunelle

SPECTOSCOPIC ANALYSIS OF INDUSTRIAL EMISSIONS FOR NITRIC OXIDE, NITROGEN DIOXIDE, AND SULFUR DIOXIDE. *Ind. Eng. Chem., 51(6):772, June 1959.*

A method for continuous monitoring of nitric oxide and sulfur dioxide in flue gases is described. Modifications to remove dust and water vapor containing sulfuric acid were made in the sampling system preceding two Beckman Model LB 21 infrared analyzers. This was done by passing the gas through a condenser at 0 C to remove the major part of the water vapor, and then through an electrostatic precipitator to remove the dust. The gas then flows through the spectrometers. The infrared provides a continuous and instantaneous record.

1958

34511 **APTIC NO. 57879**

Nader, John S.

AN ODOR EVALUATION APPARATUS FOR FIELD ANDLABORATORY USE. *Am. Ind. Hyg. J., vol. 19:1-7, 1958. 9 refs. (Presented at American Industrial Hygiene Assoc. Meeting, April 23, 1957, St. Louis, Mo.)*

The development and operation of an odor-evaluation apparatus for use in the field or laboratory is discussed. The instrument was tested in the laboratory, and data on the individual perception threshold of butyric acid, metal cresol, methyl salicylate, and toluene were obtained. An estimate of the population perception threshold was made for two of these odors. A preliminary test of its application in the field was made.

1953

34512 **APTIC NO. 57618**

Hartz, N. W.

DUST SAMPLING APPARATUS. *American Foundrymen's Society, Des Plaines, Ill. and Illinois Univ., Urbana, Ill., Dept. of Mechanical Engineering. Symp. Foundry Saf., Health, Air Pollut., Urbana, Ill., 1953, p. 89-98. 7 refs. (Feb. 17-19.)*

Old models of the impinger component of dust sampling apparatus are discussed. The midget impinger is then described and the mechanics of collecting dust samples with it are detailed. The method of count determination is given, followed by a sample calculation. An electrostatic sampler is also described, with instructions for preparation for sampling for determination by weight, count, and chemical analysis.

AIR QUALITY MEASUREMENTS

1973

34513 **APTIC NO. 57144**

Alkezweeny, A. J.

SIZE DISTRIBUTIONS OF ST. LOUIS AEROSOL PARTICLES. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 104-106, April 1973. 2 refs.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

The size distributions of aerosol particles were measured during Aug. 1972 in St. Louis as part of the METROMEX program. The height of the temperature inversion affected the particle size distribution. For a day with low-level temperature inversion, the size distribution was characterized by high concentrations of larger particles. The size distribution averaged over the entire period of measurement approximately fit the equation delta N/delta D equals 6.5 D to the -4th power, where delta N/delta D is the number of particles/cu cm/micron and D is the particle diameter in micron. Thus, the average of the particle size distributions obtained over a long period of time could be approximated, over the particle size range measured, by a Junge distribution for an aged aerosol. (Author abstract modified)

34514 **APTIC NO. 57124**

Funashima, Masanao, Kunihiko Asakura, Tomio Hirono, and Toshio Odaira

SIZE SPECTRUM OF HEAVY METALS IN AIRBORNE PARTICULATES. *(Fuyu ryushijo busshitsu no seibunbetsu ryukei bunpu). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):318, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 64.)*

The measurements of metal contents in suspended particulates and their sizes were taken in various districts of Tokyo. Samplings were taken by continuous cascade impactor for 5 to 7 days, and radioactive analysis was applied. Large percentages (60-90%) of bromide (emitted from automobiles), plus vanadium and manganese (emitted by heavy oil combustion) were found in less than 1.0 micron particle dusts. In contrast, aluminum (probably from the soil) particles were relatively large and found in suburban and residential areas. The components tested were lead, iron mn, copper, cadmium, nickel, V, and chromium. In both industrial and residential areas, extremely high amounts of Pb was found. Large particle (0.1-1.0 micron) Mn content was high in the dusts in industrial areas.

34515 **APTIC NO. 57647**

Kopczynski, S. L., W. A. Lonneman, T. Winfield, and R. Seila

GASEOUS POLLUTANTS IN ST. LOUIS AND OTHER CITIES. *Preprint, Environmental Protection Agency, 33p., 1973 (?). 14 refs.*

Gaseous air pollutants in the St. Louis metropolitan area were characterized during the fall of 1972. The analyses of roadway samples indicate certain compounds in automotive emissions such as acetylene, carbon monoxide, O-xylene, ethylene, and 2-methylpentane occur in consistent proportions to other compounds. The concentrations of these indicator compounds in atmospheric samples were used to estimate the amount of other hydrocarbons present that are attributable to automotive-related emissions. Methane, ethane, and propane originate principally from non automotive sources both St. Louis University and the St. Louis CAMP station. Similar concentrations were found in urban and nonurban areas. A comparison of ethylene-CO and propylene-CO ratios in urban and nonurban areas indicates that CO can serve as an indicator of transport of urban pollutants. Sunlight irradiations of captured air samples showed increasing ozone production with increasing initial concentrations of hydrocarbons and nitrogen oxides. Substantial O3 and peroxyacetyl nitrate were formed from a total nonmethane hydrocarbons concentration of only 1/4 ppm carbon. (Author abstract modified)

34516 **APTIC NO. 57345**

Kornmann, M and M. Polac

AIR POLLUTION MONITORING IN THE SAINT-MAUR CANTON IN 1972. *(Controle de la pollution de l air dans le canton Saint-Maur en 1972). Text in French. Pollut. Atmos. (Paris), no. 59:313-318, July-Sept. 1973.*

Results of sulfur dioxide and particulate matter monitoring conducted in the Saint-Maur canton in 1972 are presented, compared with the results of similar measurements in previous years. The yearly averages of the SO2 and particulate matter concentrations were 98 and 45 micrograms/cu m in 1972, compared to 98 and 50 micrograms/cu m in 1971. The increase in the SO2 concentration from 76 micrograms/cu m in 1968 and from 77 micrograms/cu m in 1969 was due to an increase in the fuel oil sulfur content from 0.5 to 0.7% during the same period. Both the SO2 and particulate matter concentrations were highest in winter (January), and lowest in summer (July). A close relationship between SO2 and particulate matter concentrations and ambient temperature, plus the predominant role of domestic heating in SO2 pollution were determined.

34517 **APTIC NO. 57589**

Whitby, K. T., R. E. Charlson, W. E. Wilson, and R. K. Stevens

COMMENTS ON THE PAPER ENTITLED THE SIZE OF SUSPENDED PARTICLE MATTER IN AIR BY ROBERT E. LEE, JR. *Preprint, Minnesota Univ.; Washington Univ., Environmental Protection Agency, Atmospheric Aerosol Research Section; and Environmental Protection Agency, Field Methods Development Section, 4p., 1973 (?). 6 refs.*

Since only 15-50% of aerosols collected in Lee s experiments were sized, the size distributions should not have been approximated in all cases with a log normal distribution. The data for Cincinnati and Washington, D. C. would be fitted better by a curve than by a straight line. The Lee data actually generates a biomodal distribution. Thus, in general the mass distribution of atmospheric aerosols is not log normal. Other problems of data interpretation and of experimental techniques makes many of Lee s results questionable.

1972

34518 **APTIC NO. 57265**

Bouquiaux, J. and J. Grandjean

AIR POLLUTION. SMOKE AND SO2. JULY 1972. *(Pollution atmospherique. Fumee et SO2. Juillet 1972). Text in French. Bull. Mens., Inst.,Royal Meteorol. Belgique, 1972:1-28, July 1972.*

Atmospheric sulfur dioxide and smoke concentration measurement data, furnished by a total of 230 sampling stations of the Belgian national air quality monitoring network during July 1972, is presented. The smoke samples were collected on Whatman No. 1 filter paper for subsequent reflectometric analysis, while the SO2 concentrations were determined by acidimetric titration of the absorbent liquid used in the bubbler. All concentration data constitute daily means. The monthly averages of the smoke concentrations measured in Brussels, Liege, Charleroi, Gand, and Antwerp are 19, 22, 21, 13, and 20 micrograms/cu m, with the corresponding extrema of 1-56, 1-111, 3-68, 2-39, and 2-69 micrograms/cu m, respectively. The monthly averages of the SO2 concentrations in the above-mentioned cities were 62,66, 57, 64, and 86 micrograms/cu m, while the respective minima and maxima were zero and 432 micrograms/cu m in Brussels; zero and 442 micrograms/cu m in Liege; 4 and 224 micrograms/cu m in Charleroi; 4 and 400 micrograms/cu m in Gand; and 10 and 311 micrograms/cu m in Anwerp.

34519 **APTIC NO. 57730**

Mishima, Masao, Takashi Hoshiai, Yukikazu Kuno, and Takeo Suzuki

SOME EXPERIMENTAL SURVEY ON AIR POLLUTION IN SOKA, SAITAMA PREF. *(Saitama-ken soka-shi ni okeru jidosha haigasu osen ni kansuru hitotsu no chosa). Text in Japanese. Koshu Eiseiin Kenkyu Hokoku (Bulletin of the Institute of Public Health), 21(4):212- 225, Dec. 1972. 10 refs.*

Due to an explosive increase in the number of automobiles, the atmosphere, even in small towns located in rural areas, has recently been contaminated by automobile exhaust gases. A particularly critical problem is that roads in such towns have not been constructed to suit modern automobile traffic; they are usually narrow, and consequently their atmospheres may easily be contaminated by the exhaust gases. A survey was carried out at a small city in Saitama Prefecture, Soka, where increasing attention is paid to that type of air pollution. Air pollution there has not reached a point at which subjective complaints of the residents have substantially increased, and health effects on the residents have not yet reached a level comparable to residents of big cities. Air pollution will, however, certainly become a serious problem in small towns soon if automobile traffic control systems are not provided. (Author abstract)

1969

34520 **APTIC NO. 57551**

Davies, R. R.

SPORE CONCENTRATIONS IN THE ATMOSPHERE AT AHMADI, A NEW TOWN IN KUWAIT. *J. Gen. Microbiol., 55(3):425-432, March 1969. 16 refs.*

The present study describes observations on the concentrations of pollen and fungal spores in the air at Ahmadi and discusses their origins and relevance to the development of inhalant allergy in the population. A Hirst spore trap was set up on the flat roof of the company store in central Ahmadi. Greased slides were exposed for 24 hours every few days between August and March and then scanned to determine the mean concentrations for pollen and spores. Pollens from indigenous weeds of the Chenopodiaceae were most numerous. Pollen from the introduced trees of Prosopis spicigera was trapped only sporadically at roof level, but was found in high concentrations beneath the trees. The concentration of the fungal spores of Cladosporium rose as ambient temperatures declined from the extreme heat of summer. Chenopod pollen occurred from August 1 onwards, these plants being clearly less inhibited by high temperature than the fungi. The origins of the spora and the possibility of dust being colonized by fungi in air-cooled houses is discussed. The pollen of Prosopis spicigera is the most important cause of pollinosis in Kuwait. In future planting programs the importance of this tree as an allergen should be noted, and allergic people should be instructed to avoid the trees in the April/May and November/December flowering periods.

1968

34521 **APTIC NO. 57105**

Just, Jan, Stefan Maziarka, and Halina Wyszynska

CARCINOGENIC HYDROCARBONS IN THE ATMOSPHERIC AIR IN CERTAIN POLISH TOWNS. *(Weglowodory rakotworcze w powietrzu atmosferycznym). Polski. Tygod. Lekar (Warsaw), 23(41):1553-1556, 1968. 15 refs. Translated from Polish. Franklin Institute Research Labs., Philadelphia, Pa., Science Information Services, 13p., Dec. 1969.*

During investigations on the carcinogenicity of air pollution in 10 larger Polish towns, the content of tar substances in the air was determined. The substances include: benzo(a)pyrene, benzo(e)pyrene, benzo(g,h,i)perylene, and pyrene. The concentration of aromatic hydrocarbons in the air changes within a wide range of values depending on the concentration of industrial plants in the town, on the density of the buildings, on the use of coal for heating, etc. The average concentration of benzo(a)pyrene in 1 yr was from 29 micrograms/1000 cu m in Warsaw to 133 micrograms/1000 cu m in Zabrze. Air pollution is considerable in many towns and this may contribute to the increasing prevalence of respiratory system neoplasms in the populations of these towns. (Author abstract modified)

34522 **APTIC NO. 57378**

Rassow, L.

DUST SEDIMENTATION MEASUREMENTS IN THE BITTERFELD REGION. *(Staubsedimentationsmessungen im Raume Bitterfeld). Text in German. Z. Meteorol., 20(7-8):214-216, 1968. 5 refs.*

Dust sedimentation measurements by the dry method made in the Bitterfeld (Germany) region between 1937 and 1966 show a progressively greater increase in the amount of dust, in g/sq m/yr, from 1946 on. Comparative tests of the dry and the newer, more accurate wet methods showed the necessity of increasing by 40% the values obtained by the former to render them comparable with modern data. A record of the average number of foggy days per year in Halle (located in the Bitterfeld region) during the seven decades between 1891 and 1960 exhibits a conspicuous parallel to the dust sedimentation record. Hence, fog frequency may serve as an indirect measure of dust sedimentation rate.

ATMOSPHERIC INTERACTION

1974

34523 **APTIC NO. 57715**

Evans, Leslie F., Nicholas K. King, David R. Packham, and Edwin T. Stephens

OZONE MEASUREMENTS IN SMOKE FROM FOREST FIRES. *Environ. Sci. Technol., 8(1):75-76, Jan. 1974. 5 refs.*

During a controlled burning of forest litter, ozone concentration was measured by a Mast detector and smoke plume dispersion was measured by monitoring from an aircraft. Ozone was generated when the plumes were exposed to sunlight. Close to the fire, the O3 concentration was zero due to reaction of O3 with combustion products, as the plume drifted downwind, O3 developed in the upper layer of the plume. In one case, the O3 concentration reached 0.1 ppm after 45 min of irradiation, thus warranting some concern if the O3-containing layer should reach ground level. The smoke plumes reached inversion level (2000 m from the ground) and then drifted downwind at between 15 and 22 km/hr. (Author abstract modified)

34524 **APTIC NO. 57768**

Knox, Joseph B. and Rolf Lange

SURFACE AIR POLLUTANT CONCENTRATION FREQUENCY DISTRIBUTIONS: IMPLICATIONS FOR URBAN MODELING. *J. Air Pollution Control Assoc., 24(1):48-53, Jan. 1974. 18 refs.*

With the development of ambient air quality standards (AAQS), the need arises to describe the characteristics of regional surface air pollutant concentration frequency distributions. In evaluating land use plans, numerous agencies are concerned with evaluating the effectiveness of emission zoning and/or control actions. On a regional basis, one way of performing this assessment is by determining the changes in the pollutant frequency distributions resulting from control actions. This study presents new data concerning the surface air pollutant concentration frequency distributions observed for area and continuous point sources, and compares these distributions with those of the pertinent meteorological variables describing the transport and diffusion of the pollutant. The observed surface air pollutant frequency distributions are compared to those corresponding to simple modeling concepts from either an urban area source or a continuous point source. For an urban source and a relatively inert pollutant like carbon monoxide, the observed frequency distribution for CO surface air concentration parallels the approximately log-normal frequency distribution of the reciprocal of the wind speed. The constant relating these two well-correlated frequency distributions can be determined either experimentally or with a numerical simulation model of air pollution. The usefulness of numerical models in air pollution is discussed. (Author abstract modified)

34525 **APTIC NO. 57329**

Tennekes, Hendrik

THE ATMOSPHERIC BOUNDARY LAYER. *Phys. Today, 27(1):52-55, 57, 59, 61, 63, Jan. 1974. 9 refs.*

The relationship of the atmospheric boundary layer to air pollution meteorology is discussed. Estimates of air pollution dispersal in the atmospheric boundary layer require knowledge of wind speed, wind direction, turbulence intensity, and the thickness of the boundary layer. The principal variables in air pollution dispersal over moderately long distances are the wind speed vector and the height of the mixed layer. The product of these two quantities is called the ventilation volume or flushing factor. The pollution hazards are greatest when the flushing factor is small. It is not hard to estimate the average wind speed in the boundary layer if the winds aloft and the surface topography are known. A major research problem is the boundary layer thickness and its variation from hour to hour, from day to day, and from season to season.

1973

34526 **APTIC NO. 57145**

Alkezweeny, A. J.

CONCENTRATIONS OF AEROSOL AND TRACE GASES OVER ST. LOUIS. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 109-112, April 1973. 2 refs.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

Two aircraft flights were made over St. Louis to determine the vertical and horizontal distributions of aerosol particles, sulfur dioxide, and ice nuclei. Under calm wind conditions, the aerosol concentrations were nearly invariant with altitude, but a considerable variation across the city occurred. The SO2 concentration was in the range of 0.3 to 0.6 ppm. High concentrations of ice nuclei active at -20 C were observed. The city was a significant source of ice nuclei; the sources of SO2 were located mainly above the ground, in contrast to particle sources which were located both on and above the ground. Particle concentrations were almost the same with height for a given point, but a considerable variation existed across the city for the same altitude, which indicated good vertical mixing, but limited horizontal transport caused by the calm wind condition. Concentrations were lower with a higher temperature inversion base. (Author abstract modified)

34527 **APTIC NO. 57147**

Alkezweeny, A. J.

VERTICAL PROFILES OF AITKEN NUCLEI. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 127-130, April 1973. 11 refs.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

Vertical profiles of Aitken nuclei in the atmosphere were determined over several locations in Washington State. Aitken nuclei refer to particles below 0.1 micron in size; they play an important role in cloud and aerosol-physics processes. The nuclei concentration either decreases or is nearly the same with altitude up to about 8000 ft. Above this level, the concentration continuously increases, even exceeding its value near the ground in some instances. The shape of the nucleus concentration profile suggests two sources of Aitken particles: one arises from nuclei which are transported upward by turbulent diffusion from the atmospheric boundary layer dependent upon the vertical temperature structure; the second source is formation within the atmosphere from the gas phase by photochemical reaction or from the evaporating portion of a cloud.

34528 **APTIC NO. 57148**

Alkezweeny, A. J.

AIRBORNE MEASUREMENT OF AEROSOL PARTICLE SIZE DISTRIBUTIONS. *In: Pacific Northwest Laborato-*

ry Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 131- 134, April 1973.

NTIS: BNWL-1751 PT1, UC-53 Meteorology

The concentration and size distribution of aerosol particles were measured over Seattle and over the ocean. The concentrations of particles of all sizes decreased considerably above the temperature inversion level. Particles in the range 0.3-5 m in diameter were measured using a Royco Optical System. Reduced numbers of large particles over the calm ocean at 200 and 100 ft compared with 2000 ft were due to low production of large sea spray particles.

34529 **APTIC NO. 57776**

Bach, W. and A. Daniels

AEROMETRIC STUDIES IN GREATER CINCINNATI USING AN INTEGRATING NEPHELOMETER. *Tellus (Uppsala), 25(5):499-507, 1973. 6 refs.*

Horizontal and vertical scattering profiles are presented for Greater Cincinnati. The ground and upper air profiles were obtained from a nephelometer attached to a station wagon and a Cessna aircraft, respectively. Under anticyclonic weather, the dust dome was well pronounced with scattering coefficients of .0008/m (304 micrograms/cu m) on the ground and .0005/m (190 micrograms/cu m) at 900 m MSL. The most polluted areas had 2-2.5 times higher dust loadings than the outskirts. Under cyclonic weather, the scattering profiles were flattened with values below .0002/m (76 micrograms/cu m) both for surface and upper air samplings. The vertical profiles indicated that Cincinnati s dust dome did not extend much beyond 1000-1500 m above the ground. Horizontal and meridonal scattering profiles showed that the nephelometer was well suited for monitoring small-scale changes in air pollutant concentrations due to changes in land use. In spite of inaccuracies in the assessment of absolute values, the instrument provided valuable information on three-dimensional variations of particle concentrations. (Author abstract modified)

34530 **APTIC NO. 57744**

Bergstrom, R. W., Jr. and R. Viskanta

PREDICTION OF THE SOLAR RADIANT FLUX AND HEATING RATES IN A POLLUTED ATMOSPHERE. *Tellus (Uppsala), 25(5):486-498, 1973. 32 refs.*

A direct method for the solution of the spherical harmonics approximation to the equation of radiative transfer in an inhomogeneous, absorbing, emitting, nonisotropically scattering plane-parallel atmosphere is presented. The P1 and P3 approximations of the spherical harmonics method are compared with other more detailed methods for determining the solar radiative flux and the flux divergence in an absorbing and scattering atmosphere with an arbitrary phase function. The solar heating rates due to absorption by the pollution aerosols are predicted for a model atmosphere as a function of aerosol composition, concentration distribution, and solar elevation angle. The solar heating rates for nitrogen dioxide, ozone, and sulfur dioxide are also determined. A small amount of absorbing particles can significantly affect the radiative transfer in the atmosphere. (Author abstract)

34531 **APTIC NO. 57178**

Bresser, H. and L. Kropp

DISPERSION MODEL USED IN THE COLOGNE REGION. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 4th Meet., Oberursel, West Germany, 1973, p. XII-1-XII-8. (May 28-30.)*

A dispersion model used in the estimation of air quality for the Cologne, West Germany region is described. The mathematical basis of the model is the well-known equation with gaussian distributions of concentration normal to the axis of transport, while turbulence due to meteorology and topography is described by corresponding parameters. Calculation of plume rise is done using Brigg s formula. Emissions from industry, domestic heating, and road traffic in the Cologne region were taken together to form area sources of 1 km side width for each source group, and calculations of air quality (carbon monoxide, sulfur dioxide, oxides of nitrogen, and organic gases) were performed for two turbulence situations (neutral and stable). Emissions slopes are illustrated for: summer day, neutral turbulence; summer night, stable turbulence; winter day, neutral turbulence; and winter night, neutral turbulence.

34532 **APTIC NO. 57174**

Busch, N.

INTRODUCTORY REMARKS TO THE WORKSHOP SESSION ON THE ROLE OF EMPIRICAL/STATISTICAL MODELING OF AIR QUALITY. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 4th Meet., Oberursel, West Germany, 1973, p. VIII-1-VIII-4. (May 28-30.)*

Three types of statistical schemes are offered for consideration in relation to air quality modeling and investigation: the purely statistical approach in which predictions are attempted without directly using the physics of the problem; the traditional objective forecast method which contains parameters that are determined by some best-fit procedure utilizing existing data; and analysis by use of empirical-orthogonal functions based on expansion of pollution fields in a series of orthogonal functions that are determined in such a way that the series converges as rapidly as possible. The point is also made that for given meteorological conditions, dispersion functions play the role of transfer functions between the air quality distribution and the distribution of pollutant emissions and therefore might conceivably be obtained empirically by a mathematical inversion technique (e.g., by numerical solution of sets of integral equations) utilizing accumulated data on the distributions of air quality and emissions. Accomplishment of this might remove a major shortcoming of the current statistical models and would allow for an alternative to the customary meteorological dispersion modeling.

34533 **APTIC NO. 57663**

Carter, John Wesley, Jr.

AN URBAN AIR POLLUTION PREDICTION MODEL BASED ON DEMOGRAPHIC PARAMETERS. *Oklahoma Univ., Dept. of Environmental Sciences, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1973, 171p. 118 refs.*

Statistical correlations between the regression of demographic and emissions data were used to construct a model to predict future air pollution emissions, concentrations, and costs-to-control based upon inputs from a population model. Correlations between total pollutant emissions and the demographic factors of population, number of passenger vehicles registered in the county, and percent of the work force employed in manufacturing were run for 23 cities ranging in population from 100,000 to 2 million. Land area was used to unitize the emissions on a ton/sq mi/yr basis. A linear modeling technique was employed to describe the future air pollution emissions in a growing city either on a geographical or a population-industrial growth pattern, and reductions in emissions from mobile sources as a result of the requirements of the Air Quality Air of 1967 for the manufacture of low-pollution automobile engines by 1975-76 were predicted by a step-function. Future concentrations of air pollution were predicted through the use of meteorological retention factors, while the amount of emissions in excess of the ambient air quality standards were predicted and the total cost to-abate of these excesses calculated. The model was validated against the measured emissions and concentrations of nine cities. (Author abstract modified)

34534 **APTIC NO. 57138**

Dana, M. Terry, Jeremy M. Hales, and M. A. Wolf

STUDIES OF WASHOUT FROM THE PLUME OF A COAL-FIRED POWER PLANT. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 65- 67, April 1973. 2 refs.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

Field experiments were initiated by the release of a pilot balloon from the control center at the Centralia power plant. The resulting mean wind measurement was used to establish placement of precipitation collectors. Precipitation was collected at various locations beneath the plume and analyzed chemically for sulfur dioxide, hydrogen ion, and sulfate to determine washout of sulfur compounds from the plume. During five field tests, temperature, humidity, winds, raindrop size, and trace metals in the rain were measured. The sampling and analytical systems are described, however results are not given.

34535 **APTIC NO. 57143**

Dana, M. Terry, Jeremy M. Hales, and John M. Thorp

PRECIPITATION SCAVENGING OF INORGANIC POLLUTANTS FROM METROPOLITAN SOURCES. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 93-97, April 1973.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

Rainwater samples from convective storms in the St. Louis metropolitan area were collected and analyzed for sulfur dioxide, nitrate, ammonia, nitrite, sulfate, and hydrogen ion. Preliminary results indicated significant washout of these city-produced pollutants often occurs within a few miles of the down-storm side of the city. Supporting measurements included several radiosonde flights, monitoring of weather radar, and aircraft sounding of the concentrations of several air pollutants in the area. (Author abstract modified)

34536 **APTIC NO. 57151**

Davis, W. E.

A MODEL FOR NEAR SURFACE COMPUTATION OF MONTGOMERY STREAM FUNCTIONS. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 144-148, April 1973. 3 refs.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

A model was developed to compute Montgomery stream functions from bilinear interpolated soundings from four radiosonde sites. The model is based on a bilinear interpolation of the pressures of the potential temperature surfaces for two time periods 12 hours apart. The model sounding was compared with an observed, sounding at Stampede Pass, Washington, in the Cascade Mountains. Within a standard deviation of + or 0.05 times 10 to the 7th power sq cm/sq sec, accurate stream functions could be computed over a range of 1000 mb to approximately 925 mb. The error limits on the model results will allow estimation by the model of the geostrophic wind within + or 5 m/sec for a 100 km interval at 45 deg latitude or 1 m/sec for 500 km. (Author abstract modified)

34537 **APTIC NO. 57766**

Dingle, A. Nelson and Yean Lee

AN ANALYSIS OF IN-CLOUD SCAVENGING. *J. Appl. Meteorol., 12(8):1295-1302, Dec. 1973. 21 refs.*

The fate of airborne contaminants that enter a cloud with an overriding rain, independently generated, is considered by means of three differential equations which express the overall mass conservation of contaminant. The model incorporates the physical processes of diffusive attachment, impact collection and accretion, and includes consideration of particle and cloud droplet size spectra. The rainout ratio and rainout efficiency are evaluated on the basis of theoretical results, and the general expressions for different cloud conditions are proposed. The model appears to be of general validity for scavenging, and it is expected to hold when additional physical inputs to the system are more adequately treated. (Author abstract modified)

34538 **APTIC NO. 57495**

Donaldson, Coleman duP.

ATMOSPHERIC TURBULENCE AND THE DISPERSAL OF ATMOSPHERIC POLLUTANTS. (INTERIM REPORT). *Aeronautical Research Associates of Princeton, Inc., Princeton, N. J., Environmental Protection Agency Contract 68-02-0014, Program Element No. A-11009, EPA-R4-73-016a, Rept. 186, Vol. 1, 211p., March 1973. 43 refs.*

NTIS: PB 225525/8AS

A detailed derivation of the equations describing the generation of turbulence and the transport of pollutants in the atmosphere is given. The equations are closed at the order of second-order turbulent correlations through the use of models of the higher-order correlations. The resulting invariant second-order closure model is applied to three problems: the generation of turbulence in the surface layer; the transport of passive pollutants in the atmosphere; and the complete planetary boundary layer for the case of neutral stability for both smooth and rough surfaces. Results are compared to previously gathered experimental data, and suggestions are made for improving the model for transport of passive pollutants in the atmosphere.

34539 **APTIC NO. 56961**

Dovgyallo, E. N., V. A. Kovalev, and E. A. Polyakova

THE USE OF THE BACKWARD SCATTER METHOD FOR MEASUREMENTS OF THE ATMOSPHERIC TRANSPARENCY OVER INCLINED DIRECTIONS. *(Ispol zovanie metoda obratnogo passeyaniya dlya izmereniya prozrachnosti atmosfery v naklonnykh napravleniyakh). Text in Russian. Meteorol. i Gidrol., no. 6:56-61, 1973. 9 refs.*

The conditions are considered under which the backward scatter method can be used for work in inclined directions, i.e., in the nonhomogenuous atmosphere. Recently, a theory of the method for measurement of atmospheric transparency over inclined directions was worked out, as well as the conditions under which the reverse scatter method gives the meaningful correlation between the atmospheric transparency and the intensity of the light scattered back in both homogeneous and nonhomogeneous atmosphere. The projector and receiver lines intersect under a beta angle. The receiver may measure signals from various parts of the light, depending upon the situation of the sighting lines of the receiver, which may change with the change of the alpha angle from the source or the beta angle. The test results concerning the inclined and horizontal atmospheric transparency are given for inclined rays. With due observance of a certain geometry of the measured system, the sum of backward scatter signals measured at different positions of the line of the receiver sight and taken in certain weight ratios, determines unambiguously the general transparency of the sounded atmospheric layer. The methods and results of testing the experimental installation of backward scatter in measurements of transparency in an inclined direction are described, and the equations for calculating each position are given.

34540 **APTIC NO. 57177**

Dreyhaupt, Franz Joseph

THE ROLE OF DIFFUSION MODELS IN A STRATEGIC CONCEPT FOR AIR POLLUTION CONTROL. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 4th Meet., Oberursel, West Germany, 1973, p. XI-1-XI-18. 6 refs. (May 28-30.)*

Practical aspects of diffusion modeling for air pollution control ranging from the model inputs to the various uses that are made of the output are examined. The main applications of such modeling are: calculation of an air quality inventory; calculation of the concentrations of air pollutants due to emissions from a new industrial plant in the license procedure; and calculation of buffer-zone distances for the purpose of protection against air pollution in town and regional planning. The central input for all the cases of model use is the emission inventory which provides an overall view of the contribution of individual emission sources or groups of sources to the total emission of particular constituents. The diffusion calculation makes it possible to determine the degree of pollution by a given constituent at particular points in the area. The emissions inventory can also serve as the starting point for cost-benefit analyses if the costs of improvements and advantages to man and the environment are considered. Conversion of an emission inventory of the Cologne, West Germany area into an air quality inventory, using meteorological and other factors to estimate the contribution of particular source groups or emitters to the resulting pollution load, is described.

34541 **APTIC NO. 57136**

Elderkin, C. E. and D. C. Powell

PROFILE-DERIVED ESTIMATION OF CROSSWIND INTEGRATED EXPOSURE FROM ELEVATED SOURCES: MODEL REVISIONS AND APPLICATIONS. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 34-42, April 1973. 6 refs.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

A diffusion model based on the Hay-Pasquill technique, applied to vertical dispersion and the description of deposition summarized by Van der Hoven, attempts to account for some important effects of the surface. The model estimates the crosswind-integrated exposure downstream at ground level only. The prediction of ground level exposure to a depositing tracer released from an elevated source is sensitive to changes in the roughness parameter, z sub o. At close downstream distances, the order of magnitude differences in predicted exposure are due to the differences in sigma sub z (the vertical distributions of tracer in the plume) associated with the differences in z sub o. At downstream distances on the order of 5-15 km, the predicted exposure differences are primarily due to different deposition effects associated with differences in z sub o. The same analysis for nondepositing tracer shows differences in predicted exposure at the greater downstream distances associated with changes in z sub o. However, the predicted exposures at these distances for the nondepositing tracer are of a higher order of magnitude than those for the depositing tracer. (Author abstract modified)

34542 **APTIC NO. 57172**

Fortak, H.

INTRODUCTORY REMARKS TO THE WORKSHOP SESSION ON VALIDATION OF AIR QUALITY SIMULATION MODELS. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 4th Meet., Oberursel, West Germany, 1973, p. VI-1-VI-4. (May 28-30.)*

An example of air pollution model validation is presented along with some considerations on the topic in general. The model validated was a statistical one for the German city of Bremen and produced all possible concentration fields as an ensemble of such fields, rather than in the sense of a time series. An isoline of mean value was first chosen on which monitoring stations were located to represent the structure of the field. The locations, however, were also chosen so that they were not especially favorable for simulation with the model. A heating period was chosen (1967/68) in which half-hourly mean values of concentrations were available by measurements and also by simulation computations. Both ensembles were then formed, and the statistics of these emsembles were compared with each other. The preferred method of testing the model was by the use of concentration wind roses, a much more detailed validation technique. Validation of time dependent models appears to be a much more complex task and will have to take into account the stochastic nature of the prediction and use modern concepts of space and time sampling theory.

34543 **APTIC NO. 57179**

Fox, Douglas G. and Francis Pooler, Jr.

THE REGIONAL AIR POLLUTION STUDY - UPDATED. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 4th Meet., Oberursel, West Germany, 1973, p. XIII-1-XIII-31. 18 refs. (May 28-30.)*

Updated information is presented on the Environmental Protection Agency s Regional Air Pollution Study for the development of mathematical simulation models of air pollution processes. A continuous monitoring network is to be established, with research being conducted in the areas of emission inventory, physical and chemical atmospheric transformations, atmospheric structure, dispersion, and removal processes. A network of air quality and meteorological instrument stations will be established within an area roughly enclosed by a circle of 30 km radius for the Gateway Arch, St. Louis, Mo., as its center. A central support facility will be provided for automatic and manual data handling and processing. Other components of the St. Louis Facility for field studies will include mobile monitoring stations, mobile laboratories, atmospheric sounding stations, helicopter and aircraft instrument platforms and miscellaneous other measurement capabilities. The sampling station areal density will be roughly proportional to the gradients of long-term mean concentrations, while shorter-term gradients will be measured by the portable instrumentation. An attempt will also be made to provide a reasonably complete set of source-receptor relationships.

34544 **APTIC NO. 57175**

Gifford, F. A.

INTRODUCTORY REMARKS TO THE WORKSHOP SESSION ON SIMPLICITY VERSUS SOPHISTICATION IN AIR QUALITY MODELING. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 4th Meet., Oberursel, West Germany, 1973, p. IX-1-IX-3. (May 28-30.)*

A simple area source diffusion model which was developed by the Atmospheric Turbulence and Diffusion Laboratory of the National Oceanic and Atmospheric Administration has been found to compare favorably with a number of more complex air pollution models and with a large mass of air pollution. Comparisons included annual particle pollution mean values, annual and seasonal sulfur dioxide and particle urban area pollution patterns (i.e., spatial distribution), short-term area pollution patterns down to one hour, time-varying carbon monoxide (traffic) pollution values up to 48 hr, and photochemical pollutants. The bases for the model were the observations that: concentrations at a receptor point can only be influenced by sources in a narrow, plume-shaped upwind sector and the grid scales of urban area source-inventory patterns are typically much larger than point source plume widths. Consequently, the need was seen to incorporate only upwind variation of source-strengths and along-wind variation of diffusivity into the area source model. The success of the model appears to indicate that the gross influence of variations of source strength, mean wind transport, and atmospheric stability exert the primary control over urban air pollution.

34545 **APTIC NO. 57626**

Godshall, Fredric Allen

ARTIFICIAL DEVELOPMENT OF AN ATMOSPHERIC BOUNDARY LAYER FLOW MODEL IN A WIND TUNNEL. *Maryland Univ., Dept. of Civil Engineering, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1973, 120p. 83 refs.*

A thermally stable boundary layer wind flow model was artificially produced in a wind tunnel for the purpose of studying atmospheric diffusion. Average vertical distributions of wind speed and temperature in Philadelphia during periods wherein the Monin L was equal to 1000 ft served as a prototype for the model, and a linear scaling factor equal to L was used for the model. The magnitude of L was equal to one foot, and vertical gradients of temperature and wind speed required for the model were those which determined this magnitude. The characteristic length scale for turbulent eddies was chosen to be equal to the quotient of the average wind velocity divided by the periodic frequency of turbulent wind velocity fluctuations. Thin wooden strips, one inch wide, were used to produce the model turbulence, and a bar-screen was used to produce a logarithmic vertical distribution of wind velocity in the one foot-deep model. A logarithmic vertical variation of temperature over the model depth was produced by an oil-fired heater and electrically heated rods. Hot wire anemometry and cold wire temperature measuring equipment were used to measure vertical heat and momentum flux in the model, and these fluxes were used to compute a flux value for L which was equal to the gradient determined value of L. The suitability of the model for study of atmospheric diffusion was demonstrated by this test of eddy flux in the model. (Author abstract modified)

34546 **APTIC NO. 57747**

Huff, F. A. and S. A. Changnon, Jr.

PRECIPITATION MODIFICATION BY MAJOR URBAN AREAS. *Bull. Am. Meteorol. Soc., 54(12):1220-1232, Dec. 1973. 29 refs.*

Historical weather records at eight American urban areas of varying type, size, and climate were studied for indications of inadvertent precipitation modification. The cities were St. Louis, Chicago, Indianapolis, Cleveland, Washington, Houston, New Orleans, and Tulsa. The six largest cities all experienced warm seasonal rainfall increases of 9-17% during the 1955-1970 period. The increases in the Midwest cities occurred largely with cold fronts, but in the coastal cities they were largely during air mass (nonfrontal) conditions. The Midwest increases also occurred as enhancement, not initiation, of moderate to heavy rain days. Significant increases in summer thunder-day frequencies (13-41%) and hail-day frequencies (90-450%) were found at the six largest cities, and the increases occurred largely in the morning hours. The typical locations of maxima in the Midwest cities were thunder over and near the city, and rain and hail 25-55 km downwind. The maxima of all events in coastal cities were in or near the city. Overall, urban precipitation enhancement was related to city size, industrial nuclei generation, and urban thermal effects. The alterations have considerable relevance to urban design, local area forecasting, local water supplies, agricultural production, hydrologic design, and planned weather modification. (Author abstract modified)

34547 **APTIC NO. 57173**

Klug, W.

INTRODUCTORY REMARKS TO THE WORKSHOP SESSION ON THE ROLE OF REGIONAL AIR POLLUTION STUDIES IN MODEL DEVELOPMENT. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 4th Meet., Oberursel, West Germany, 1973, p. VII-1-VII-5. (May 28-30.)*

The role of regional air pollution studies in model development is examined. Inference can be made from the structure of the concentration field on how detailed the model calculations should be in order to represent relevant features of the field, and deductions can be made concerning the type of model that should be used for the concentration data in connection with the synchronous meteorological data. It might also be possible to obtain estimates of the relative contributions of different types of sources from the structure of the concentration field under different meteorological conditions; this could also be inferred by considering ratios of concentrations of different constituents. It should also be possible to infer whether or not sources outside the area under consideration have to be taken into account under certain meteorological conditions.

34548 **APTIC NO. 57761**

Konrad, Thomas and Freda L. Robison

DEVELOPMENT AND CHARACTERISTICS OF FREE CONVECTION IN THE CLEAR AIR AS SEEN BY RADAR AND AIRCRAFT. *J. Appl. Meteorol., 12(8):1284-1294, Dec. 1973. 15 refs.*

Observations of the development of a convective field in clear air were made simultaneously using radar and an instrumented aircraft. The growth of the field as seen by the radar was compared with the characteristics of the temperature and humidity measurements made by aircraft at various times and locations within the convective depth. Probability distributions of the temperature and mixing ratio fluctuations exhibited distinct, identifiable characteristics for different regions within the field. The altitude of the aircraft measurement, referenced to the maximum altitude of the convective field at the time of the measurement, was a usable parameter in the comparison of aircraft data and in the characterization of convective field growth. Using the relative height parameter, the area covered by convective cells (modified air) varied linearly with height in the upper reaches of the convective field. The characteristics of individual cells as seen by the radar and as deduced from the aircraft measurements are also discussed. (Author abstract)

34549 **APTIC NO. 57696**

Kuznetsov, G. I. and N. I. Izhovkina

TWO MODELS OF ATMOSPHERIC AEROSOLS. *(Dve modeli atmosfernogo aerozolya). Text in Russian. Izv. Akad. Nauk SSSR Fiz. Atmosfery i Okeana, 9(9):947-953, 1973. 15 refs.*

The spectral aerosol optical density was investigated for two different models of atmospheric aerosols; clean sea atmosphere, and a turbid continental atmosphere. The calculation results obtained were compared with experimental data on spectral attenuation in different geographical regions and for different altitudes up to 30 km. In the sea atmosphere, the optic density of Aitken particles of continental origin is negligible to that of large and giant particles for wavelengths greater than 0.2 micron. The attenuation was constant, and the size distribution of the particles was very slightly at altitudes higher than 6 km. While the spectral aerosol optic density for the entire 0-30 km layer of the atmosphere followed a normal course and the respective attenuations caused by the aerosol fractions of 0.1-1.0; 1.0-2.5, and 1.5-5 micron were in the same order of magnitude, the course of the aerosol optic density for the 3-30 km layer was slightly anamalous due to the major contribution to attenuation by giant particles. The elimination of the ground-layer of the troposphere and of the stratosphere, respectively, resulted in decreases in the optic density by 33% and 50%. In the turbid continental atmosphere, an increase in the attenuation with increasing particle size, a reduction in the attenuation with altitude for large particles, and an increase in the attenuation with increasing altitude for giant particles were determined. The normal course of the aerosol optic density for the 0-30 and 3-30 km due to the predominant contribution of the Aitken particles to the attenuation of ultraviolet and visible light in the lower and middle troposphere was noted.

34550 **APTIC NO. 57140**

Lee, R. N.

SNOW SCAVENGING OF LEAD PARTICULATES. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 72-75, April 1973. 5 refs.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

A short field study was conducted on the Hanford Reservation to evaluate the effectiveness of snow scavenging for the removal of lead aerosols generated by automotive exhaust. A grid network of snow samplers in the vicinity of a highway was used. The collected snow was analyzed for lead by atomic absorption spectrophotometry. During an initial run on Jan. 5, 1973, 1.1 in. of snow fell, of which 0.1 in. fell from 6 to 9 am. The data may be biased by windblown snow. Lead concentrations in snow and temperatures were measured. Under appropriate conditions snow was an effective scavenger of particles. (Author abstract modified)

34551 **APTIC NO. 57582**

Lin, Chin-I

LIGHT ABSORPTION BY ATMOSPHERIC AEROSOL AND ITS GLOBAL CLIMATIC IMPLICATIONS. *Washington Univ., Dept. of Geophysics, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1973, 94p. 71 refs.*

A relatively simple opal glass method was selected and extensively developed in a study of the process of aerosol light absorption and its climatic implications. Aerosol light absorption is important to processes which contribute to the attenuation of radiation in the atmosphere, and increasing aerosol load in the atmosphere results in an appreciable change of mean global temperature. Light extinction due to absorption by atmospheric particles, although very small, was also found to be important. Opal glass measurements indicated that light absorption by urban aerosol particles is appreciable and cannot be neglected as it has been in the previous heat balance studies of the atmosphere. Urban and industrial aerosols were shown to be much more absorbent than natural maritime aerosol. The value of the aerosol absorption coefficient measured by the opal glass method was found to be accurate to well within an order of magnitude, and the new technique is expected to provide, for the first time, measurements of the absorption coefficient which can be used to model radiative effects of aerosol. (Author summary modified)

34552 **APTIC NO. 57322**

Mattana, N., G. P. Porra, and A. Serra

FIVE YEARS OF OZONE MEASUREMENTS OVER CAGLIARI (SARDINIA). *(Cinq Annees de Sondages Ozone sur Cagliari (Sardaigne)). Text in French. Pure Appl Geophys. (Basel), 106-108(5-7):1169-1179, 1973. 9 refs.*

Between Feb. 1967 and Feb. 1972, 157 ozone determinations were carried out by the Brewer type electrochemical ozone sensing device at various altitudes over Cagliari. Comparison tests with the Brewer-Mast instrument type 730-5 showed the Brewer sensing device to furnish comparable results. Sixty-nine percent of the results exceeded 20 mb, 55% 15 mb, 29% 10 mb, and 8% 6 mb. In the troposphere, a secondary maximum can be measured at an altitude of 2 km in all seasons. From this altitude up, the partial ozone pressure tends to diminish to a minimum value just below the tropopause. The mean vertical distribution of ozone levels in the stratosphere has different characteristics in each season. In autumn, the partial ozone pressure increases slowly with altitude reaching a maximum of about 150 mb at an altitude of 23-24 km. In summer, a secondary maximum can be observed in the low stratosphere at an altitude of 13 km, then a slow gradual increase attains 155 mb at 23 km as the main maximum. In the spring, considerable ozone accumulation can be noted in the layer below the tropopause at an altitude between 10 and 15 km where the partial pressure of ozone reaches values exceeding 90 mb which is about 60% of the main maximum of 152 mb observable at an altitude of 22 km. In winter, the secondary maximum is in the lower stratosphere and the main maximum reaches at an altitude of 22 km the level of 192 mb. The comparison of various ozonograms with altitude and temperature profiles indicates that almost in all cases a close correlation exists between ozone level and temperature variations.

34553 **APTIC NO. 57137**

Nickola, P. W.

A COMPARISON OF MEASURED EXPOSURES WITH EXPOSURES COMPUTED FROM MEASURED AND FROM PASQUILL S SIGMA SUB Y AND SIGMA SUB Z VALUES. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 52-57, April 1973. 6 refs.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

Plume dimensions and exposures (time integrated concentrations) observed during an example field test are described. During the field test, fluorescent particulates were used as a tracer and emitted from 26 m. Stability, mean wind speed, mean wind direction, direction standard deviation, and temperature were observed. The observed dimensions and exposures are compared to exposures computed by means of a commonly used Gaussian plume model. The sigma sub y and sigma sub z values (the horizontal and vertical distributions of tracer in the plume) used in the model are those prescribed by the Pasquill curves, and those actually observed during the field test. The observed and computed exposures are at considerable variance in all cases. The discrepancies are partially due to the lack of consideration of deposition in this Gaussian model. (Author abstract modified)

34554 **APTIC NO. 56972**

Ohno, Yoshiaki and Kiyoshi Masuo

STUDIES ON ESTIMATING METHOD OF AUTO-EXHAUST GAS POLLUTION. *(Jidosha haishutsu gasu osen chosa hoho no hitotsu no kokoromi). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):331, Oct. 1973. (Presented at the Japan. Society for Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 76.)*

An attempt was made to develop a method of predicting the carbon monoxide concentration at a given traffic intersection by establishing a correlation with a standard intersection. The wind direction and velocity, the weather, atmospheric stability, traffic amounts, traffic stagnation, buildings, side walks, topography, and the road width were considered. Actual measurements were taken at 13 intersections, and 12 were found to have significant correlations within 1% danger rate. Correlation coefficents correlation ratios, standard error, reliability were obtained. Under the uniform weather conditions and the same traffic pattern, continuous monitoring of CO measurement at the standard intersection can present measurements at other intersections.

34555 **APTIC NO. 56980**

Palmer, Bradley J.

A REVIEW PAPER ON THE EFFECT OF CARBON DIOXIDE AND AEROSOLS ON CLIMATE MODIFICATION. *Environ. Letters, 5(4):249-265, 1973. 58 refs.*

Information on the climatic effect of carbon dioxide and aerosols is reviewed. Recent downward trends in the average surface temperature have lead some scientists to conclude that albedo (turbidity) increases due to the effect of aerosol backscatter is the cause. While there is evidence for and against this hypothesis, albedo changes due to aerosol modification of cloud cover may be a more significant mechanism for explaining temperature trends. Fossil fuel combustion, marine carbon, and soils may be major sources of CO2. Sinks include oceans and vegetation. Carbon dioxide is increasing at more than 1.0 ppm per year. Added CO2 should exert a warming influence on the biosphere, but the aerosol effects evidently negate the effect of CO2. (Author abstract modified)

34556 **APTIC NO. 57774**

Rozenberg, G. V.

ESTIMATION OF THE ABSORPTIVE POWER OF ATMOSPHERIC HAZE FROM CLOUD BRIGHTNESS. *Bull. Acad. Sci. USSR, Phys. Atmos. Oceans (English translation from Russian of: Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana), 9(5):256-261, May 1973. 32 refs.*

A method is proposed for estimation of the absorptive power of atmospheric haze from cloud brightness. The absorption in clouds (outside of the molecular absorption bands) is strong and governed by the fine particle cloud fraction that produces moist haze. The volume absorption coefficient of haze in the visible region outside of the molecular absorption bands for fine particles is around 0.06/km, while the coefficient of haze is less than or equal to 0.01/km for the coarse fraction. The presence of large condensation nuclei has only a weak influence on the optical parameters of the cloud. (Author abstract modified)

34557 **APTIC NO. 57132**

Sehmel, G. A. and F. D. Lloyd

INFLUENCE OF SOIL RESUSPENSION ON THE AIRBORNE PARTICLE SIZE DISTRIBUTION. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 1-5, April 1973. 2 refs.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

The airborne particle size distribution function of resuspended soil was determined as a function of particle diameters from 1 to 230 micron and sampling heights from 0.3 to 30 m. An apparent lower limit was determined for the size distribution function. Soil resuspension can cause relatively high soil injection rates into the atmosphere which increase the magnitude of the size distribution function above the lower limit. The soil resuspension rates are a direct function of the hours of high wind speed occurring during dusty time periods. However, the resuspension rates must also be a function of the persistence of these high winds since less resuspension occurs for the same total hours of high winds when these hours are accumulated over a longer time period. (Author abstract)

34558 **APTIC NO. 57134**

Sehmel, G. A. and M. M. Orgill

RESUSPENSION BY WIND AT ROCKY FLATS. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 15-22, April 1973. 9 refs.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

Airborne plutonium concentrations were related to meteorological parameters at Rocky Flats to increase understanding of environmental resuspension processes. The meteorological data included hourly wind speed and direction and maximum daily wind gust at the tower site. The anemometer was located 40 ft above ground and .75 mi west of the oil spill area. Despite low activity levels and smoothing of variability in airborne concentrations performed by sampling over relatively long periods of time, the reported data were useful in defining some dependencies of resuspension on meteorological parameters. The maximum resuspension factors, for scoping estimates, were in the range of 10 to the -5th power to 10 to the -9th power/m for 6 hr, 48 hr, and weekly air samples collected near the east security fence and at 2-3 mi from the plant. Since the airborne concentration should also be related to an upwind and not a local surface contamination, the airborne concentrations at one sampling station were related to wind speed for July 1970 to Jan. 1971. The model for wind-caused plutonium resuspension at this sampling station was the average airborne concentration in uits of fCi/cu m equals 0.45 times the average west and southwest wind speed to the 2.1 power in mi/hr. The linear correlation coefficient for the model was 0.89. The theoretical model was proportional to wind speed to the 2.0 power rather than the experimental wind speed to the 2.1 power. The model predicts that total activity in each hourly time period is equal to the plutonium fallout activity in fCi/cu m during the time period plus 0.3 plus 0.45 (mph) to the 2.1 power.

34559 **APTIC NO. 57133**

Slinn, W. G. N.

INITIAL RESUSPENSION MODELS. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 5-15, April 1973. 10 refs.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

The resuspension of aerosol particles from the earth s surface was studied theoretically. For friction velocity greater than or approximately equal to 20 cm/sec, horizontal wind fluctuations can dislodge most sub-millimeter particles from dry soil. This suggests that the soil particle size distribution is the controlling factor of the airborne particle size distribution in the near-surface layer. Above the surface layer, the convective diffusion equation is incapable of explaining experimental data. The resuspension of the material into the forced convection layer depends almost entirely on the statistical properties of the turbulence. A statistical approach based on the probability distribution of vertical wind speeds is explored; the observed wind speed data does correctly describe the size distribution of large, resuspended particles. Directions are indicated for future theoretical and experimental studies. (Author abstract modified)

34560 **APTIC NO. 57139**

Slinn, W. G. N.

THE REDISTRIBUTION OF A GAS PLUME CAUSED BY REVERSIBLE WASHOUT. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 68- 71, April 1973. 1 ref.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

An analytical study was made of the influence on a gas plume of reversible scavenging by rain. The result predicts that at large time, a plume will be washed downward at a rate of H prime J sub o, where J sub o is the rainfall rate and H prime is the dimensionless Henry s law constant. Results are shown for the specific case of a sulfur dioxide plume. (Author abstract)

34561 **APTIC NO. 57141**

Slinn, W. G. N.

POSSIBLE CHANGES IN AEROSOL PARTICLE DISTRIBUTIONS CAUSED BY IN- CLOUD SCAVENGING. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 83-85, April 1973. 2 refs.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

Predictions are made about the evolution of aerosol particle number and volume distributions caused by interaction with simple nonprecipitating, warm clouds. The rate of decrease of the Aitken nuclei concentration is shown, as is the influence of trace gas conversion on the size distribution of those particles which are active as cloud condensation nuclei. (Author abstract)

34562 **APTIC NO. 57146**

Slinn, W. G. N.

ON EDDY DIFFUSIVITY AND COSMOGENIC RADIONUCLIDES. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 123- 127, April 1973. 10 refs.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

An experiment is proposed to use vertical profiles of certain cosmogenic (cosmic-ray-produced) radionuclides to infer the vertical profile of the eddy diffusivity in stable layers of the troposphere. Chlorine(39), sodium(24), and beryllium(7) seem especially suitable radionuclides. After an initial time is identified when a specific air mass experiences an event which distorts the equilibrium distribution of the radionuclides, the vertical profiles of the radionuclides would be measured for as long a time as possible in an attempt to follow the equilibration of the profiles. The calculation of the eddy diffusivity from the results would be straightforward.

34563 **APTIC NO. 57149**

Slinn, W. G. N.

SOME MEASUREMENTS OF ATMOSPHERIC AEROSOL PARTICLES. *In: Pacific Northwest Laboratory Annual Report for 1972 to the USAEC Division of Biomedical and Environmental Research. Volume II: Physical Sciences. Part 1. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., p. 135-137, April 1973.*

NTIS: BNWL-1751 PT1, UC-53 Meteorology

During a two-week period in the summer of 1972, aerosol particle size distributions and concentrations were measured at ground level sites at an elevation of 4000 ft in the Blue Mountains of Oregon, on the north shore of Monterey Bay, California, at 6000 ft in the Rocky Mountains near Aspen, Colorado, and at Edwardsville, Illinois. The size distributions were obtained with a Royco optical particle counting system. The particles were in the range of 0.3 to 8 micron diameters. The effects of resuspension, temperature, humidity, winds, and precipitation were noted. During rain, little resuspension occurred, presumably because the soil was damp, and the concentration of submicron particles was reduced, possibly through the influence of scavenging. Reduced concentrations of submicron particles in Edwardsville during the night occurred because of reduced human activities. The dependence of number distribution on particly diameter varied from steeper than diameter to the -4 power at the Blue Mountain site (where considerable contributions came from pollen emitted by a nearby dry-grass field), to about D to the -4 at the Monterey Bay site (where there was considerable influence from nearby pollution sources), to about D to the -2 in the very clean air in the Colorado Rockies.

34564 **APTIC NO. 57180**

Turner, Bruce D. and Russell F. Lee

USERS NEEDS AND THE APPLICATIONS OF AIR QUALITY SIMULATION MODELS. *North Atlantic Treaty Organization, Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 4th Meet., Oberursel, West Germany, 1973, p. XIV-1-XIV-21. 31 refs. (May 28-30.)*

Adequate air quality simulation models currently exist for stable pollutants such as sulfur dioxide, suspended particulates, and carbon monoxide from both isolated point sources and for multiple source situations in urban areas. Such models can be applied to both short averaging times, on the order of an hour to a day, and for longer seasonal and annual averaging times. Adequate models do not exist, however, for including complex topography, either for point sources or for urban areas; nor do such models exist for the stagnation case where wind velocities are extremely light and winds are variable. Need also exists for models where transformation and removal processes occur, as in the formation of secondary air pollutants. Models for stable pollutants do exist that will handle line sources such as from automatively generated pollution. Research is currently underway in the United States on numerical models for complex topography, stagnations, and reactive pollutants; and it is hoped that physical modeling through wind tunnel and water channel methods will be useful in the solution of air quality problems whery there is complex topography. (Author summary modified)

34565 **APTIC NO. 57765**

Yordanov, D. L.

A SIMPLE ONE-LAYER MODEL OF PLANETARY BOUNDARY LAYER. *Dokl. Bolg. Akad. Nauk, 26(8):1029-1032, 1973. 1 ref.*

A simple one-layer model of the planetary boundary layer is described considering the components of the dimensionless defect of velocity, the dimensionless components of tension of turbulent friction, the dimensionless vertical component, and the coefficient of turbulent exchange. The equations enable the profiles of the components of turbulent friction and wind to be found approximately, in the presence of the pulsation measurements of the coefficient of vertical turbulent exchange. When the coefficient of turbulent exchange is a constant, the equations of the components of the dimensionless defect of velocity are transformed into the well-known Eckmann spiral.

34566 **APTIC NO. 57327**

Zuyev, V. Ye., L. S. Ivlev, and K. Ya. Kondratyev

RECENT RESULTS FROM STUDIES OF ATMOSPHERIC AEROSOLS. *Bull. Acad. Sci. USSR Phys. Atmos. Oceans (English translation from Russian of: Izv. Akad. Nauk. SSSR, Fiz. Atmosfery i Okeana), 9(4):204-212, 1973. 46 refs.*

Recent research on atmospheric aerosols includes simultaneous optical and microphysical measurements in the surface layer, a model of the complex refractive index, aerosol absorption in the troposphere, chemical composition of troposheric aerosols, the structure of stratospheric aerosols, and the shape of the aerosol particle size spectrum. A coagulation mechanism of particle growth at low humidities is proposed in lieu of the swelling and water-shell hypotheses, with particle coagulation dependent on the relative humidity. The three-level model of the atmospheric aerosol can be used with close approximation only for the fine particle fraction. The water shell hypothesis no longer withstands criticism at relative humidities below 80% in light of new experimental data. Nor can the swelling hypothesis explain many of the phenomena observed in atmosphere, although it may be valid under nontypical specific conditions. Mechanisms such as condensation on rough surfaces and coagulation are more probable, and the condensation process will apparently take place only when the nuclei are soluble with difficulty and, consequently, cannot result in strong particle growth and the appearance of fine particle foggy hazes, but it does provide a good explanation of the brightening effect. Although it is fragmentary, the physical picture of the shaping of the atmosphere s aerosol structure presented explains the experimental data of various authors in large part without contradictions, and can be taken as a base for construction of an aerosol model of the atmosphere. (Author conclusions modified)

1972

34567 **APTIC NO. 57292**

Byzova, N. L.

METEOROLOGICAL CHARACTERISTICS USEFUL IN THE CALCULATION OF DIFFUSION OCCURRING IN THE BOUNDARY LAYER OF THE ATMOSPHERE. *(Meteorologicheskiye kharakteristiki dlya rascheta diffuzii v pogranichnom sloye atmosfery). Text in Russian. Inst. Eksp. Meteorol., no. 27:60-60-69, 1972. 13 refs.*

Meteorological parameters necessary for the calculation of boundary layer diffusion processes are surveyed. A high degree of accuracy in the calculation of pollutant dispersion in the boundary layer of the atmosphere requires a correspondingly complex set of meteorological parameters to be measured. The minimum set of meteorological parameters necessary for an approximate calculation of boundary layer diffusion processes includes wind velocity, to be measured at one level, e.g., that of the weather vane or of the emission source; the stratification characteristics, to be determined from the same wind velocity; the cloudiness; and the position of the sun. The accuracy of the calculations can be increased by including more detailed meteorologic parameters. For such purposes, the wind velocity should be measured at one more level, e.g., at that of the emission source, and the profile should be determined for two points. To determine the mean velocity of the wind within the given layer, wind speed should be measured in several intermediate points. The ground-layer parameter of the atmospheric stratification should be determined by ground-layer gradient measurements, and also the temperature profile should be measured for the determination of the boundaries of the inversion layers.

34568 **APTIC NO. 57232**

Eddy, Amos

THE AIR POLLUTION COMPONENT OF AN ECOSYSTEM SIMULATION MODEL. *International Biological Program, Ann Arbor, Mich., Aerobiology Program. Ecol. Syst. Approaches Aerobiol. II. Dev., Demonstr., Eval. Models, Proc. Workshop/Conf. II, Boulder, Colo., 1972, p. 19-21. 6 refs. (July 12-14.)*

NTIS: AP-USIBP-H-73-3

A numerical-stochastic model of an urban-rural, human-oriented ecosystem running on a computer is described. Major subroutines comprise the climatology, hydrology, botany, zoology, and urban aspects of the ecosystem. Pollution is simulated to affect the rate of production of above ground live biomess in the botany segment, the precipitation rate and patterns in the atmospheric segment, the population dynamics in the urban segmant, and the industrial operating procedures in the urban segment. The use of pollution sub-models is discussed for air pollution above the surface and on the surface. Specific modeling procedures are described for measuring pollution patterns induced by several industrial processes in an urban area considering time series of wind and temperature data. When wind and stability data are simulated, diffusion models can be used to specify the surface intersections of air pollution plumes produced by each industrial source. The ecosystem model can be used to study the consequences of management procedures.

34569 **APTIC NO. 57501**

Flowers, E. C., R. A. McCormick, K. R. Kurfis, and T. H. Bilton

ATMOSPHERIC TURBIDITY MEASUREMENTS WITH THE DUAL-WAVELENGTH SUNPHOTOMETER. *Preprint, Environmental Protection Agency, and Dept. of Commerce, Washington, D. C., National Oceanic and Atmospheric Administration, 19p., 1972 (?). 9 refs.*

Atmospheric turbidity measurements and the dual wavelength sunphotometer are discussed. The instrument can resolve turbidity variations of + or .005, but its long-term stability is still undetermined. Data from the world network indicate that the turbidity is higher in summer than in winter over most of the globe. Distinctive features noted in earlier studies of turbidity such as the wide monthly and annual range of B values in the eastern part of the United States, show up in the current data. The first year of dual wavelength data from some of the new stations suggests that they may not be representative of a larger area. Their data are valuable in studying variability and trends in local (urban) areas. Insufficient data prevent any assessment of the significance of the wavelength exponent values. For a few stations that have been examined, the average annual alpha values are slightly smaller than the mean value of 1.3 suggested by Angstrom. The main value of alpha may be for local analysis for the separation of distinctive aerosol types. (Author summary modified)

34570 **APTIC NO. 57121**

Garger, Ye. K.

CALCULATION OF THE PARAMETERS OF HORIZONTAL DIFFUSION FROM TURBULENCE CHARACTERISTICS. *(K raschetu parametrov gorizontal'noy diffuzii po turbulentnym kharakteristikam). Text in Russian. Inst. Eksp. Meteorol., no. 27:82-90, 1972. 17 refs.*

Calculation of the parameters of horizontal diffusion from turbulence characteristics at altitudes of a few hundred meters is described. The dispersion of particles emitted from a fixed emission source, and the dispersion of cloud particles relative to the momentary center of gravity of the cloud are the two basic parameters of horizontal diffusion in a plane perpendicular to the wind direction. The close relationship between the lagrangian and eulerian turbulence characteristics greatly facilitates the calculation of the horizontal diffusion parameters. Actual measurements revealed a pronounced decrease of the dissipation of the turbulent energy with increasing atmospheric stability and increasing altitude. The dissipation of the turbulent energy was by one order of magnitude greater under instable and neutral stratification conditions than it was during weak to moderate stability.

34571 **APTIC NO. 57119**

Gisina, F. A., G. D. Dzholov, and D. L. Laykhtman

CONCENTRATION DISTRIBUTION OF POLLUTANTS EMITTED BY PERMANENT, HIGH POINT SOURCES. *(Raspredeleniye kontsentratsii primesi, postupayushchey v atmosferu ot vysotnogo nepreryvnogo tochechnogo istochnika). Text in Russian. Inst. Eksp. Meteorol., no. 27:70-76, 1972. 3 refs.*

Factors determining the horizontal distribution of pollutants emitted by permanent, high paint sources are reviewed, and a closed equation system of the turbulent motion in stationary, temperature-stratified boundary layers is given for the calculation of the dimension less concentration of the pollutants at ground level. Equations describing the diffusion of pollutants emitted from sources with effective heights over 100 m, the wind speed profile, the turbulence coefficient, as well as such parameters as the Rossby number, and a stratification parameter, are given. The effects of pollutant decay, washout and settling on the ground-level concentrations are also taken into account. Washout leads to a decrease in the ground-level pollutant concentration, and a shift in the concentration maximum toward the emission source. Gravitational sedimentation causes the ground-level concentration to increase.

34572 **APTIC NO. 57238**

Hage, Keith D.

ATMOSPHERIC DISPERSION MODELS - THEORY AND PRACTICE. *International Biological Program, Ann Arbor, Mich., Aerobiology Program, Ecol. Syst. Approaches Aerobiol. II. Dev., Demonstr. Eval. Models, Proc. Workshop/Conf. II, Boulder, Colo., 1972, p. 3-16. 9 refs. (July 12-14.)*

NTIS: AP-USIBP-H-73-3

The essential theoretical and semi-empirical guidelines used in formulating most mathematical models of atmospheric transport and diffusion are briefly summarized with emphasis on identifying necessary assumptions and theoretical gaps. Because of many weaknesses in the theory, extensive field work was carried out in the past and will be in the future to establish the validity of mathematical models. Two particular models for the transport and dispersion of rather large particles were selected for more detailed consideration, not because they are unique or particularly accurate, but because they are familiar and serve to illustrate specific problems. They consider large particle dispersion and variable winds. Relatively simple models yield useful estimates of time-averaged particle concentrations and deposits for short travel distances (up to a few km) and for very large (global) distances. However, complex calculations and difficult and costly field tests are needed for estimates of the fate of particles over distances of a few km to a few thousand km. Applications of models of this kind to aerobiological problems is feasible, but will require data from aerobiologists on source geometry, particle sizes and shapes, particle emission rates, and processes affecting particles in flight. (Author summary modified)

34573 **APTIC NO. 57409**

Kornreich, Lawrence D.

INVESTIGATION OF THE BEHAVIOR OF OZONE AND NITRIC OXIDE IN THE LOWER TROPOSPHERE. *North Carolina Univ., Chapel Hill, Dept. of Environmental Sciences and Engineering, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1972. 122p. 51 refs.*

Examination of ambient air quality data collected at several locations indicates that the apparent coexistence (i.e., simultaneous measurement) of nitric oxide and ozone can be explained in terms of atmospheric mixing processes. As nighttime begins, there is an average concentration of ozone present in the air mass which becomes inhomogenous as a result of various destructive processes. Concomitant with this is the continual release of nitric oxide from nonuniform sources at the surface. The net result of these processes is the creation of microparcels of air, some O3-rich and some NO-rich. During thermally stable conditions these inhomogeneities are preserved by restricted vertical movement. Over the long term, O3 and NO do react in the atmosphere, as indicated by the general trend toward declining O3 concentrations during the night. Under thermally stable conditions, when vertical mixing is active, the simultaneous measurement of the two gases is the result of the continual injection of NO and O3, resulting in a quasi-steady state condition, during which the rate of transport is equal to, or greater than, the rate of reaction. The data suggest that atmospheric inhomogeneity is a major factor in the phenomenon of coexistence. (Author summary modified)

34574 **APTIC NO. 57120**

Krasnovskaya, L. I., A. V. Levin, and A. V. Tkachenko

SOME CHRACTERSTICS OF HORIZONTAL TURBULENT DIFFUSION IN THE ATMOSPHERE, AND THEIR EVALUATION FROM THE DISPERSION OF POLLUTANTS EMITTED BY INSTANTANEOUS SOURCES. *(Nekotoryye kharakteristiki gorizontal noy turbulentnoy diffuzii v atmosfere i ikh otsenka po rasprostraneniyu primesi ot mgnovennogo istochnika). Text in Russian. Inst. Eksp. Meteorol., no. 27:76-82, 1972. 13 refs.*

The characteristics of horizontal turbulent diffusion were studied by investigation of the diffusional expansion of the artificial zone of crystallization, provoked by instantaneous emissions, in supercooled stratified clouds. The variation of the breadth of the artificial zone of crystallization as a function of time revealed two characteristic types; one featuring practically linear growth of the breadth for short durations, followed by accelerating, and then by decelerating growth, and another type of linear growth with subsequently decelerating growth. The experimental study of the artificial crystallization processes occurring in clouds permits the dependence of the characteristics of horizontal turbulent diffusion of the atmospheric status parameters to be investigated.

34575 **APTIC NO. 57239**

Lighthart, Bruce and A. S. Frisch

A MODEL TO EVALUATE THE AIRBORNE BACTERIAL CONCENTRATION FROM A CONTINUOUS SOURCE. *International Biological Program, Ann Arbor, Mich., Aerobiology Program, Ecol. Syst. Approaches Aerobiol. II. Dev., Demonstr. Eval. Models, Proc. Workshop/Conf. II, Boulder, Colo., 1972, p. 139-149. 10 refs. (July 12-14.)*

NTIS: AP-USIBP-H-73-3

Many animal and plant pathogenic bacteria are transmitted from susceptible host to susceptible host through the atmosphere. A point source continuous diffusion model was used to evaluate the dispersion of bacteria given the source height and meteorological conditions. The concentration of bacteria injected into the atmosphere as a function of distance from the source also depends onthe initial concentration of cells at the injection site and the death rate of cells in the ambient atmosphere after injection. Therefore, the dispersion model was theoretically modified to account for the death rate. Bacterial death rate was also evaluated in the laboratory. If a source of Bacillus subtilus bacteria 10 m above ground level emits 10 to the 8th power bacteria per second into a mean wind speed of 1 m/sec, the concentration at 2 km downwind is 200 bacteria/cu m with no death rate (if the relative humidity is 50% and if there is no carbon monoxide in the atmosphere). The concentration of Serratia marcescens would be 80 bacteria/cu m, with humidity of 0% and 84 ppm CO, the number of S. marcescens would be 1/cu m. This is a reduction by a factor of 200 compared with zero death rate. The death rate/dispersion model may be incorporated as a submodel in a human or plant infection cycle system. Many of the compartment variables shown in these models may be evaluated stochastically from known information, and the entire system can be used as input variables for large-scale ecosystem models.

34576 **APTIC NO. 57411**

Lynam, Donald Ray

THE ATMOSPHERIC DIFFUSION OF CARBON MONOXIDE AND LEAD FROM AN EXPRESSWAY. *Cincinnati Univ., Div. of Graduate Studies, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1972. 178p. 113 refs.*

Multiple linear regression analysis and the statistical Gaussian diffusion model were utilized in predicting the atmospheric dispersion of lead and carbon monoxide from a high speed, heavily travelled expressway. The maximum atmospheric concentration of lead was 15.08 micrograms/cu m, while that of CO was 10.5 ppm; both were measured 20 ft downwind from the edge of the roadway during stable atmospheric conditions and under a traffic volume of 4682 vehicles/half hour. The mean lead and CO levels, which were measured upwind of the expressway and represented background levels, were 0.4 micrograms/cu m and 1.5 ppm, respectively. The data indicate that the major portion of the lead particles emitted in automobile exhaust is removed rather rapidly by dry deposition, including sedimentation, impaction, Brownian motion, coagulation, and electrostatic attraction. Lead and CO were highly correlated, especially at distances close to the expressway, but the regression of lead on CO varied with the distance from the expressway. A multiple linear regression model for lead was developed, and the statistical Gaussian diffusion model, which was modified to include multiple infinite line sources, was a good predictor of atmospheric CO concentrations downwind of an expressway. (Author abstract modified)

34577 **APTIC NO. 57112**

Ohira, Toshio, Mashaski Ito, Sabro Fukuoka, and Mitsuru Udagawa

RESEARCH ON PREDICTING AIR POLLUTION FROM METEOROLOGICAL DATA (REPORT III). *(Kishoyoso karano taiki-osen-yosoku ni kansuru kenkyu). Tokyo Metropolitan Research Inst. Environmental Protection (Kogaiken) (Japan), 97p., Feb. 1972. 8 refs. Translated from Japanese.*

The prediction of sulfur dioxide pollution in Tokyo from meteorological factors was investigated. The gross success rate for high SO2 pollution forecasts for Dec. 1970 and Jan.-March 1971 was 63.7% in the forecasts for the next day, and 92.5% in the forecasts for the current day in the coastal areas. The prediction of pollution intensity level A had a poor success rate. In order to improve the prediction accuracy, it was necessary to determine atmospheric stability conditions from the ascending airflow for 700 mb, and an isopleth for 850 mb, prediction of temperature for 850 mb. In order to predict the SO2 potential in a quantitative manner, the model equations for predicting daily mean SO2 density were formulated based on a multiple correlation method by investigating the relationship between each weather factor and SO2 density. The SO2 pollution potential is correlated with wind velocity, atmospheric stability, daily mean SO2 density, and the correlation coefficient is over 0.8. (Author conclusions modified)

34578 **APTIC NO. 57240**

Outcalt, Samuel I.

A SIMULATION MODEL OF URBAN ENVIRONMENTS. *International Biological Program, Ann Arbor, Mich., Aerobiology Program, Ecol. Syst. Approaches Aerobiol. II. Dev., Demonstr. Eval. Models, Proc. Workshop/Conf. II, Boulder, Colo., 1972, p. 22-26. 6 refs. (July 12-14.)*

NTIS: AP-USIBP-H-73-3

A simulation model of urban environments can be used to understand the manner in which land use mosaic (i.e., the three dimensional geometry of man-made structures, vegetation, and topography) influences the physical well-being of urban man. Simulator output of the spatial-temporal field of surface temperature was checked against field thermal scan data for various terrain types, and gave reasonable results. Some aerobiological applications are discussed. The general simulator was modified for the urban reconnaissance task. These modifications permitted the parameterization of the optical aerodynamic, and thermal properties of a tract of urban land using only two dimentionless numbers and a length. The geographic boundary conditions for the test simulation are discussed. The simulated surface temperatures for one day are shown. The numerical surface climate simulator appears to provide a suitable vehicle for the analyses of urban climate/land use interaction.

34579 **APTIC NO. 57118**

Sakharov, V. M., K. P. Kutsenogiy, G. N. Zagulyayev, I. P. Pavlov, and A. P. Goncharov

SUITABILITY OF A LARGE-CAPACITY AEROSOL GENERATOR FOR AIR POLLUTANT DISPERSION STUDIES. *(Vozmozhnosti moshchnogo aerozol nogo generatora pri issledovanii rasprostraneniya primesi). Text in Russian. Inst. Eksp. Meteorol., no. 27:104-110, 1972. 1 ref.*

The dispersion of a huge diesel oil aerosol cloud, emitted by a large-capacity aerosol generator at a temperature of 300 C at a speed of 200-250 m/sec and at a rate of 200 l/min was studied by aerophotography and phototheodolite stereo photography. The upper edge of the aerosol cloud, composed of particles of about 1 micron, reached up to 300 m, and aerosol was detected at distance of 10 km and more. The photographs permitted the evaluation of the effect of wind speed and wind direction as well as of their variations on the horizontal and vertical dispersion of the aerosol. The evaluation of the photographs and propagation time measurements show the strong influence of the kinetic energy of the aerosol jet emitted on the propagation of the aerosol within a distance of 1 km. The time required by the aerosol to reach a point 500 m of the aerosol generator was 2-3 times shorter than that calculated from the wind velocity.

34580 **APTIC NO. 57296**

Ulrich, B.

THE FILTRATING FUNCTION OF THE GROUND. *(Die Filterfunktion von Boeden). Text in German. Society for Ecology, Proc. Conf. Load Loadability Ecosystems, Giessen, West Germany, 1972, p. 169-174.*

The filtrating and buffering capacity of the ground with respect to solid wastes, fertilizers, and air pollutants is outlined. The bulk of all air pollutants is washed out of the atmosphere by precipitation, while another part, such as sulfur dioxide, is filtered out by plants. Finally, all air pollutants end up in the soil whose properties will thereby be modified more or less considerably. Acid precipitation, due to the washout of SO2 from the atmosphere, lowers th pH value of the soil, and results in such changes as the impairment of the biological status of the soil, inhibition of vegetation, and the accumulation of aluminum in the soil.

34581 **APTIC NO. 57291**

Zhigalovskaya, T. N. and N. M. Kireyeva

ON TRACE ELEMENT CONTENTS IN THE FRONTAL ZONE, AS DETERMINED FROM MEASUREMENTS CONDUCTED IN HIGH-ALTITUDE METEOROLOGIC MASTS. *(O soderzhanii nekotorykh mikroelementov v zone frontov po izmereniyam na vysotnoy meteorologicheskoy machte). Text in Russian. Inst. Eksp. Meteorol., 2(36):55-65, 1972. 17 refs.*

Trace element concentrations in different air masses and frontal zones were measured on a 300 m-high meteorologic observation tower. The considerable differences observed in the trace element concentrations in different air masses and frontal zones were conditioned by the chemical properties of the surface of the aerosol particles and by their origin. The concentrations of titanium, zinc, and tin in frontal zones exceeded the mean values by about one order of magnitude. An absolute increase by 150 to 200% in the concentrations of sodium, potassium, and calcium was noted. The concentrations measured in cold air masses before warm fronts (continental polar air) were 6 to 8 times lower than the mean values, while in warm air masses before cold fronts (maritime polar air) the concentrations were largely at the same level as the mean values. In cold air masses behind arctic fronts (maritime arctic air), the concentrations were about 2 times lower than the mean values.

34582 **APTIC NO. 57273**

Brookhaven National Lab., Upton, N. Y., Radiation Div., Analytical Chemistry Group, Atmospheric Chemistry Research Group, and Meteorology Group

THE ATMOSPHERIC DIAGNOSTICS PROGRAM AT BROOKHAVEN NATIONAL LABORATORY: FOURTH STATUS REPORT. *Atomic Energy Commission Contract AT(30-1)-16, 59p., June 1972. 44 refs.*

NTIS: BNL 50361

A status report is presented for the Brookhaven atmospheric diagnostics program. An isotope ratio tracer method was used to follow the oxidation of sulfur dioxide in plumes from coal-burning power plants, and the rate of conversion of SO2 to sulfate was considerably lower than in the plume of an oil-fired plant. Some evidence was found for sulfate falling out of the plume near the stack. Sulfur isotope ratio measurements were also used to indicate the source of sulfur bearing particulates in the stratospheric Junge layer. A portable, real-time gas chromatographic detector was developed and used to trace sulfur hexafluoride injected into a power-plant stack, both aloft and on the ground. A detection limit of less than 10 to the minus 12 parts of SF6 per part of air was achieved routinely. Plume profiles determined by SF6 tracing and by the optical densitometer were in good agreement, but the SF6 method was much more sensitive; plume dispersion measurements with SF6 were made well beyond 100 km from the source. The effect of wind shear on plume structure was also noted, and errors inherent in establishing plume dispersion parameters on the basis of single pass measurements in the plume were indicated. The method for collection of sulfate particulates in the atmosphere was improved; and a procedure is presented for distinguishing between sulfuric acid, ammonium sulfate, and other sulfates and bisulfates in small samples of particulates collected. Development of an isotope ratio tracer method for nitrogen oxides, based in the N14/N15 ratio, is also being pursued. (Author abstract modified)

1971

34583 **APTIC NO. 57351**

Chandler, T. J.

AIR POLLUTION AND URBAN CLIMATES. *Preprint, National Society for Clean Air, Brighton, England, part 1, p. 44-55, part 2, p. 23-32, 1971. 18 refs. (Presented at the National Society for Clean Air Conference, Folkestone, England, Nov. 2-5, 1971.)*

The interrelationship of pollution, temperatures, and air flow on urban atmospheres are discussed. The concentrations of pollution are determined by the relationships between emission, diffusion, and deposition. The temperature lapse rate is a fundamental parameter affecting the diffusion of atmospheric pollution. In urban areas temperatures are generally higher than in adjacent rural areas. The most intense heat islands occur mainly by night and are particularly strong when skies are clear and the air is calm. Heat island strengths are closely related to local urban development densities and are responsible for the instability of city air compared to neighboring rural areas. The mean and turbulent structure of the wind is important to the transport and diffusion of pollution. Mean horizontal windspeeds are reduced in urban areas, while vertical motion over towns is greater than in surrounding rural areas. Turbulence is increased over cities by the dynamically rough surface presented by the buildings as well as higher temperatures.

34584 **APTIC NO. 57661**

Deniau, R. and P. Mery

PRACTICAL APPROACHES FOR SOLUTION OF SOME PROBLEMS IN CONNECTION WITH THE ESTIMATION OF AIR POLLUTION BY STACK EFFLUENTS. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 2nd Meet., Paris, France, 1971. p. IV-1-IV-32. 12 refs. (July 26- 27.)*

A method for the estimation of air pollution by stack effluents, based on the works of Pasquill is presented along with some approaches to developing better diffusion models for determining ground level concentrations of pollutants emitted by large power plants. Estimation of sulfur dioxide ground level concentrations in the vicinity of a power plant currently consists of adding tri-hourly values calculated by Pasquill s method over a large period. Another model, however, has been proposed to overcome the deficiencies of the usual diffusion formulas by taking into account vertical velocity and diffusivity profiles, using turbulent diffusivities instead of the standard deviations. Wind tunnel experiments on developing a method of boundary layer thickening by the injection of air at the beginning of a test plate have shown that the injection of air upstream of a boundary layer presents an interesting method for the thickening of this layer and therefore of simulating the atmospheric surface layer.

34585 **APTIC NO. 57400**

Krablin, Richard

DEVELOPMENT OF A RADON MONITORING SYSTEM AND ITS USE TO STUDY TURBULENT DIFFUSION IN THE LOWER 1000 FEET OF THE ATMOSPHERE. *Drexel Inst. of Tech., Philadelphia, Pa., Dept. of Physics, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1971, 143p. 36 refs.*

A two-filter radon monitoring system was designed and constructed for continuous and automatic operation. The system sampled air from a fixed tower at four levels, 20, 200, 570, and 890 ft. Wind velocities and temperature were also measured at 40, 100, 200, 350, 570, and 890 ft. The tower is situated in rolling, suburban terrain in northwest Philadelphia, Pa. The Rn measurements were made every hour for 4 months. The average uncertainty was 7%, with a sensitivity of 8 times 10 to the -15th power/Ci. The system was thoroughly tested and proved reliable. Calibration was accomplished by a simple procedure of comparison to a known source. Averages by hour of the day for each month are presented and discussed. A wind directional dependence was noted and explained as a probable result of the proximity of the Atlantic Ocean. Exhalation rates of Rn from the earth are calculated from concentration profiles and compared to published values. A theory of a power law for the height dependence of the turbulent diffusion coefficient for radon Kz is presented with a solution for the time independent diffusion equations. The observed Rn profiles are compared to theory with good agreement for cases of neutral and stable lapse rates, with exponents 0.82 and 0.50, respectively. Magnitudes of Kz are calculated as 10 sq and .001 sq m/sec at 1 m for the neutral and stable lapse rates. Wind profiles for the neutral and stable cases are predicted by a power law for Km, the eddy viscosity, with the same exponents as the Kz case. A discussion is given of the ratio Km/Kz. (Author abstract)

34586 **APTIC NO. 57355**

Martell, Edward A.

RESIDENCE TIMES AND OTHER FACTORS INFLUENCING POLLUTION OF THE UPPER ATMOSPHERE. *In: Man s Impact on the Climate. William H. Matthews, William W. Kellogg, and G. D. Robinson, (eds.), Cambridge, Mass., MIT Press, 1971, Chapt. 35, p. 421-428. 30 refs.*

Present knowledge of the meteorological factors and residence times which control the distribution of contaminants in the upper atmosphere, the background distribution of water vapor in the stratosphere, and related topics are reviewed. Circulation and mixing processes that control the redistribution of contaminants in the upper atmosphere vary widely with altitude, latitude, and season, and the mean residence time of contaminants increases appreciably with altitude between the tropopause and stratopause. Both the water vapor mixing ratio and the concentration of stratospheric water vapor increase with altitude. Background information on the upper atmosphere distribution of water vapor, hydrogen compounds, carbon dioxide, and other minor constituents should be improved by periodic observations of their distribution, and better values for the residence time of trace constituents in the upper stratosphere and mesosphere should be obtained. It is also desirable to investigate the distribution of the important minor constituents in the upper atmosphere and to gain a fuller understanding of their influence on chemical and physical processes. In addition, attention should be given to the extent to which large thermonuclear explosions at the earth s surface and in the troposphere may have increased the water content of the stratophere and to possible temporary influences on climate in periods following such tests.

34587 **APTIC NO. 57683**

Norwine, James Randolph

CITIES, AIR POLLUTION, AND REGIONAL CLIMATE: A QUANTITATIVE ANALYSIS OF THE RELATIONSHIPS BETWEEN CLIMATOLOGICAL PARAMETERS AND URBAN INFLUENCES, PRIMARILY ATMOSPHERIC POLLUTION, IN THE SIX-STATE REGION OF THE UNITED STATES GULF OF MEXICO COASTLINE. *Indiana State Univ., Terre Haute, Ind., Dept. of Geography, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., May 1971, 345p. 238 refs.*

A study was made of the urban climatic effect, particularly air pollution, on a region consisting of the six states adjacent to the United States Gulf of Mexico coastline. Statistical analysis of meteorological and atmospheric pollution data indicated the following: mean temperatures were positively related to urban variables, especially in January and for the year as a whole; fewer extremely cold days and heating degree days occurred in large urban areas; mean January precipitation was positively related to city parameters; mean annual snowfall was significantly reduced in large cities; and mean annual relative humidity was reduced in large cities except near mid-day. The opposing nature of the climatic influences exerted by certain of the urban variables was also revealed. Mean air pollution was positively related to mean annual snowfall, while snowfall was negatively related to other urban variables. A similar dichotomy was noted for several other climatological parameters. The problems encountered in attempting the analysis of short-term regional urban climatic effects proved prohibitive, the main hindrance being the dominance of individual weather systems over short time periods. (Author abstract modified)

34588 **APTIC NO. 57657**

Selamoglu, Suha

REPRESENTATION OF GROUND SURFACE EFFECT BY SURFACE SOURCE DISTRIBUTION IN ATMOSPHERIC DIFFUSION OF POLLUTANTS. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 2nd Meet., Paris, France, 1971, p. IX-1-IX-19. 3 refs. (July 26-27.)*

The ground level pollutant concentration due to a point or crosswind line source has been found to be greater by a factor of up to 10 at its maximum when calculated by the distributed surface method rather than the conventional image source method. The increase was due to the limited diffusion in the vertical direction since the new method does not permit a vertical velocity component for the diffusing pollutant. The method, although not practicable since it requires much more computer time than the simple Gaussian model with image source, has demonstrated that the problem of turbulent diffusion of pollutants in the atmosphere admits to different solutions depending upon the method of approach. (Author conclusions modified)

34589 **APTIC NO. 57658**

Selamoglu, Suha

PHYSICAL AND CHEMICAL TRANSFORMATIONS IN AIR POLLUTION MODELING. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 2nd Meet., Paris, France, 1971, p. VIII-1-VIII-7. 3 refs. (July 26-27.)*

Physical and chemical transformation considerations essential to air pollution modeling are considered. Each process within the atmosphere may be associated with a rate which indicates how fast it proceeds; and the rate is affected by a series of interwoven factors such as the temperature, pressure, water content of the atmosphere, intensity of solar radiation, and motion of the atmosphere. Rate constants governing each process must be found before various simplifications can be confidently made. The collection of processes in a reasonable first approach should be kept to a minimum by narrowing the interest to the phenomena that occur within the mixing layer of thy atmosphere where processes are more likely, and within a relatively short time interval, to be significant from the local air pollution standpoint. All sources and sinks external to and independent from the systme should also be known, and their rates of production or absorption of the corresponding species should be included.

34590 **APTIC NO. 57659**

Selamoglu, Suha

MODIFICATIONS TO THE CLIMATOLOGICAL AIR POLLUTION MODEL FOR ANKARA. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 2nd Meet., Paris, France, 1971, p. VII-1-VII-7. 2 refs. (July 26-27.)*

A number of possible modifications to Calder s climatological dispersion model are introduced for the purpose of making the model more elastic in relation to the area of focus, Ankara, Turkey. The expression for the average pollutant concentration within a wind sector for unit wind frequency is rewritten so that it is not necessary to introduce the dispersion function and the exponential function, thus simplifying the computer work without causing a great error. Consideration is also given to equally spaced crosswind line sources that are distributed in such a way that the resultant effect is approximately equivalent to that of the original area source distribution. Space heating is the major source of air pollution in Ankara; thus, a correlation between the emission strength and the meteorological parameters such as temperature and wind speed is introduced into the model. Finally, since the elevation from sea level varies in Ankara within 300 m, the value that corresponds to the measurement between the upper lid and the ground is varied.

34591 **APTIC NO. 57660**

Selamoglu, Suha

DEPENDENCE OF POLLUTANT CONCENTRATION ON THE SPATIAL VARIATION OF A CROSSWIND LINE SOURCE. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 2nd Meet., Paris, France, 1971, p. VI-1-VI-6. 1 ref. (July 26-27.)*

The crosswind variation of pollutant concentrations may be neglected when the nonuniformity in the line source distribution is not too strong; and, if the nonuniformity term containing the factor q is looked upon as a perturbation on the mean source distribution Qm, then the variation of the concentration is proportional to the perturbation parameter q/Qm. Resulting variations in the pollutant concentration are small when an area source distribution may be expressed in terms of a series of crosswind line sources, and when the variation of the source strength is small relative to its mean value. Crosswind variation drops out of the calculation of climatological pollutant concentrations due to area sources as a result of the long-term averaging relative to the wind direction; however, when the short-time averaged concentration is required, the crosswind variation due to area sources distributed over a large area may also be neglected if the nonuniformity in the source distribution is not too large. (Author conclusions modified)

34592 **APTIC NO. 57656**

Snyder, William H.

SIMILARITY CRITERIA FOR THE APPLICATION OF PHYSICAL MODELS FOR THE STUDY OF AIR POLLUTION METEOROLOGY. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Panel Air Pollut. Modeling, 2nd Meet., Paris, France, 1971, p. X-1-X-42. 41 refs. (July 26-27.)*

Similarity criteria for modeling atmospheric flows in air and water are reviewed, and it is demonstrated that five nondimensional parameters plus nondimensional boundary conditions must be matched in model and prototype. The neglect of the Rossby number can lead to serious errors in modeling diffusion in a prototype with a length scale greater than about five km. The Reynolds number, the Peclet number, and Reynolds Schmidt product criteria may be neglected if the model flow is of a sufficiently high Reynolds number. The Froude number criterion appears to be the most important. The complete specification of boundary conditions is found to be nebulous. Both air and water appear to be suitable fluids to use as modeling media. (Author abstract modified)

34593 **APTIC NO. 57407**

Soderlund, G. and Heikki Lehtinen

THE PROPERTIES OF RUN-OFF WATER. *(Dagvattnets beskaffenhet). Text in Swedish. Scand. Symp. Water Res., 7th, Jyvaskula, Finland, April 27-29, 1971, p. 239-282. 15 refs. (April 27-29.)*

Results of urban run-off water chemical analyses are presented. Hydrocarbon contents of up to 1 ppm, and traces of lead were found in fresh snow, which indicates washout of pollutants by snow from the atmosphere. Snow samples taken in and along streets and highways with busy traffic featured the highest Pb content of all samples.

34594 **APTIC NO. 57655**

Velds, Carel Andre

ATMOSPHERIC PHYSICAL AND CHEMICAL TRANSFORMATION OF POLLUTANTS AS EFFECTING URBAN POLLUTION MODELING. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 2nd Meet., Paris, France, 1971, p. XI-1-XI-3. (July 26-27.)*

The necessity of considering the physico-chemical behavior of a pollutant in the atmosphere in addition to its dispersion resulting from atmospheric motion is stressed in relation to mathematical modeling of urban air pollution. Sulfur dioxide is an example where the following mechanisms have to be considered: photochemical oxidation to sulfur trioxide by radiation; its relation to other pollutants especially strongly oxidizing materials such as nitrogen dioxide, ozone, and peroxides; sulfuric acid droplet formation in the presence of water vapor; the effect of hygroscopic particles containing dissolved catalysts on the rate of SO2 oxidation; and the efficiency of natural removal of SO2 from the atmosphere by washout, rainout, fallout, and the adsorption on surfaces such as soil and vegetation. Measurements of vertical profiles of sulfur dioxide and sulfuric acid concentrations may also be helpful, and the development of measuring methods and techniques for the determination of sulfuric acid and sulfates appears necessary. Currently five institutes in the Netherlands are engaged in such work.

34595 **APTIC NO. 57654**

Weber, Erich

REMOVAL OF SULFUR DIOXIDE FROM THE ATMOSPHERE. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 2nd Meet., Paris, France, 1971, p. XII-1-XII-14. 21 refs. (July 26-27.)*

Studies on the removal of sulfur dioxide from the atmosphere indicate that the relationship between the concentration of the pollutant and its residence time is probably in the form of an exponential function. The half-life time, as measured in the plume of power stations or in a big city during the winter, seems to vary from 10 min to 1 hr or more, depending mostly on meteorological conditions such as humidity, cloudiness, rain intensity, and fog. Oxidation to ammonia sulfate is very rapid in the presence of catalysts and ammonia. Residence time of SO2 in background regions is much slower, i.e., in the range of 4 to 7 days. (Author conclusions modified)

34596 **APTIC NO. 57652**

Worley, Frank L., Jr.

SULFUR DIOXIDE REACTIONS IN THE ATMOSPHERE. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 2nd Meet., Paris, France, 1971, p. XIV-1-XIV-6. 9 refs. (July 26-27.)*

Sulfur dioxide conversion mechanisms and removal processes from the atmosphere are reviewed. Photochemical oxidation of SO2 in the presence of nitrogen dioxide and hydrocarbons can be an important process in the atmosphere at the low concentrations found in urban areas; the rate and extent of this reaction depend on the concentration of water vapor in the air and the SO2 concentration. Sulfur dioxide and NO2 also react to form a solid product which has been identified as nitrosylbisulfate; this photochemically induced reaction occurs in addition to the usual sulfur trioxide and nitric oxide products. Laboratory studies have shown that SO2 increases the amount of hydrocarbon aerosols under some conditions, but it is not known whether this aerosol is formed using sulfuric acid as a nucleating agent or is a sulfur containing organic compound. Sulfur dioxide can also be adsorbed by particulates containing a metal oxide, hydroxide, or carbonate; and this mechanism may be significant in urban-industrialized areas since these compounds are generated by combustion of leaded gasoline, coal, or fuel oil. The absorption of SO2 by water particles containing catalysts or alkaline material such as ammonia or soluble hydroxides results in the formation of sulfate salts or sulfuric acid, and sulfate salts formed by adsorption or absorption may be transported many kilometers if the particles are not removed by washout, rainout, or gravity. Agglomeration or growth of particles due to absorption of moisture can aid in the removal of particles by gravity. Field studies indicate that SO2 may also be absorbed and removed without oxidation, though the removal process is complicated by the fact that the dissolved SO2 is readily desorbed by changing temperature, pressure, or gas concentration.

34597 **APTIC NO. 57653**

Worley, Frank L., Jr.

REPORT ON MATHEMATICAL MODELING OF PHOTOCHEMICAL SMOG. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 2nd Meet., Paris, France, 1971, p. XIII-1-XIII-75. 7 refs. (July 26-27.)*

A review of the mathematical modeling appraoch to the study of photochemical smog is presented. Two approaches to the solution of equations which describe the accumulation of photochemical pollutants during a specified time at a given place are presently being considered. Each approach includes sub-modules which predict the temporal and spacial distribution of emissions, compute the rate of generation of smog components by photochemical reactions, and predict transport and diffusion of pollutants. One of these, the trajectory approach, uses wind trajectories in predicting the movement of an air parcel or cell through the region and is totally dependent upon extensive field measurements which are needed to develop the trajectory and initial pollutant concentration to date. The approach is attractive because of its mathematical simplicity but is extra sensitive to any error along the path because it cannot be averaged to reduce its effect on the final concentration. Two versions of the trajectory model have been applied to the Los Angeles Basin. A single well mixed cell version has not demonstrated good agreement with field data, while use of multiple cells to account for vertical diffusion appears to have resulted in improved quality of prediction. A second approach to modeling attempts to solve the three-dimensional, time- dependent mass balance equations and thus predict the distribution of pollutants for the region of interest. Recent advances in the type of approximation and the size of the spatial and temporal grid have greatly increased both speed and accuracy and appear to open the way for use of this modeling approach. Preliminary results of these new advances as incorporated into a transport/diffusion sub-model have been encouraging.

34598 **APTIC NO. 57651**

Zimmerman, John R.

SOME PRELIMINARY RESULTS OF MODELING FROM THE AIR POLLUTION STUDY OF ANKARA, TURKEY. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 2nd Meet., Paris, France, 1971, p. XV-1-XV-28. (July 26-*

Preliminary results are described for the application of a dispersion model to compute the distribution of air pollution (sulfur dioxide and particulates) over the city of Ankara, Turkey. Application of Gaussian plume dispersion, with no allowance for variation of terrain elevation in this valley city, was found unrealistic; thus, a simple variation of the box model concept was employed. Linear relationships of observed and computed pollution concentrations derived from the modified box model version of the climatological dispersion model were employed to calibrate the output of the box model version, and the linear correlation coefficient for SO2 was above the 95% significance value. The correlation coefficient in the case of particulate matter, however, was under the 95% significance level. The pattern of calculated mean SO2 was almost congruent with the pattern of SO2 emissions, displaced slightly southward due to the prevalence of northerly winds. The highest computed concentration was centered over the core of the city, the region of highest population density. Maximum annual mean SO2 has been projected to increase from the present 190 micrograms/cu m to 280 micrograms/cu m in 1990. The projected 1990 contours of particulate matter show essentially the same features as the projections of SO2; an increase in concentration 160 micrograms/cu m in 1990 is predicted.

1969

34599 **APTIC NO. 57561**

Lawrence, E. N.

EFFECTS OF URBANIZATION ON LONG-TERM CHANGES OF WINTER TEMPERATURE IN THE LONDON REGION. *Meteorol. Mag. (London), 98(1158):1-8, Jan. 1969. 5 refs.*

Changes of temperature in central London during the period 1920-1968 are compared with changes at other stations in southeast England. Mean values of the daily minimum and maximum temperatures for the winter season were examined. The most marked change from 1930 to 1950, attributed to urban effects, is a decrease in the mean daily minimum temperature in central London of approximately 1 C, and an increase of approximately 0.5 C in the mean maximum temperature. These temperature changes are considered to be the result of urban improvements and of the difference between urban and rural areas in their response to natural climate change. After 1950, changes in temperature differences were less marked, in spite of the Clean Air Act of 1956, the increase in duration and quality of winter sunlight, and the decrease in London fog.

34600 **APTIC NO. 57599**

Stevenson, Catherine M.

THE DUST FALL AND SEVERE STORMS OF 1 JULY 1968. *Weather (London), 24(4):126-132, April 1969. 7 refs.*

A dust fall which occurred over England and Wales on July 1, 1968 had an average depth of between 0.1 and 1 micron. When the dust reached England on June 30, it was restricted mainly to a layer of the atmosphere between about 10,000 and 17,000 feet. The dust provided an abundant source of condensation and freezing nuclei, and it was the rain from these high-based, convective clouds which deposited the dust. In addition to the dust fall there were severe storms which produced large hail and considerable rainfall; there were marked pressure fluctuations at ground level. Also, the level of the sea moved irregularly with a fluctuation imposed on the tidal motion, and temperature in London reached 32 C. The air which was over England at different heights originated from different parts of Europe and Africa. The source of the lower layer, which was relatively dust-free, was Europe and the Mediterranean, while the origin of the higher layer, which was within the dust-layer of 10,000 to 17,000 feet, was near the southern edge of the Sahara Desert. Sandstorms were reported in this vicinity on June 28.

1968

34601 **APTIC NO. 57161**

Georgii, H. W.

INFLUENCE OF METEOROLOGICAL PARAMETERS ON THE EMISSION CONCENTRATION OF AIR POLLUTANTS. *(Ueber die Einwirkung meteorologischer Parameter auf die Immissionskonzentration luftverunreinigender Komponenten). Text in German. Arch. Tech. Messen, no. 395:257-262, Dec. 1968. 12 refs.*

Three Frankfurt am Main installations for continuous automatic measurement of sulfur dioxide, carbon monoxide, nitrogen dioxide, hydrogen sulfide, carbon dioxide, and hydrocarbon, concentrations are described. The stations also monitor wind speed and direction, temperature, relative humidity, and radiation balance. Yearly, weekly, and daily periodicities of pollutant concentrations are correlated with industrial and meteorologic factors. The dependence of CO and SO2 concentrations on wind speed, and the changes of SO2 concentration with temperature inversion are discussed in detail.

34602 **APTIC NO. 57229**

Haenel, Gottfried

THE REAL PART OF THE MEAN COMPLEX REFRACTIVE INDEX AND THE MEAN DENSITY OF SAMPLES OF ATMOSPHERIC AEROSOL PARTICLES. *Tellus (Uppsala), 20(3):371-379, 1968. 13 refs.*

The computation and the physical explanation of the spectral extinction of light in the atmosphere are mainly influenced by some specific prerequisites such as the number and the size of the atmosphere aerosol particles as well as their complex refractive index. Both size and complex refractive index are functions of the relative humidity. A new quantitative method was developed for the simultaneous measurement of the real part of the mean complex refractive index and the mean density of samples of atmospheric aerosol particles was determined.

This measuring method and the first preliminary results of measurements are presented. The arithmetical means of nine measurements are 1.57 for the real part of the mean complex refractive index and 2.7 g/cc for the mean density. Both these values are valid for a relative humidity of 0.40 + or 0.05. These measurements have been used for computing the dependency of both these quantities on the relative humidity. Formulae for these computations are deduced and the computational results for two samples of aerosol particles are presented. While the relative humidity varied between 0 and 1, for both samples the real part of the complex refractive index varied between 1.33 and about 1.7 and the mean density between 1 g/cc and about 4 g/cc. (Author abstract modified)

34603 **APTIC NO. 57589**

Meszaros, E.

ON THE SIZE DISTRIBUTION OF WATER SOLUBLE PARTICLES IN THE ATMOSPHERE. *Tellus (Uppsala), 20(3):443-448, 1968. 14 refs.*

The size distribution of water-soluble atmospheric particles was measured by the simultaneous operation of a multiple-stage impactor and membrane filters. Samples were collected for 11 months and were colorimetrically analyzed for ammonium. Nephelometric methods were used to determine the sulfate content of nine samples and the chloride content of two. The highest fraction of ammonium particles was in the Aitken size range. Of the total sulfate mass, a higher fraction was found in the large particle range. However, sulfate particles are hygroscopic and in a free atmosphere a substantial fraction will be found in the Aitken range. Only a small fraction of chloride particles was in the Aitken range. There was an ammonium excess, particularly in the smaller particles, which was caused by the presence of ammonium hydroxide. Ammonium sulfate particles can activate Aitken nuclei in small cumulus forming over Central Europe.

34604 **APTIC NO. 57572**

Rein, Frantisek

THE METEOROLOGICAL CONDITIONS FOR AIR POLLUTION ON THE SOUTHERN SLOPES OF ERZGEBIRGE. *(Meteorologische Bedingungen der Luftverunreingung an den Suedhaengen des Erzgebirges). Text in German. Z. Meteorol., 20(1-6):101-105, 1968. 2 refs.*

Studies of the temperature lapse rate on the Southern slopes of the Erzgebirge showed that stable conditions prevail frequently. Unstable conditions are limited to the warm season. The stable condition in fall and winter is frequently accompanied by fog. The stable layer reaches no higher than 600 m above sea level. At the same time, high pressure zones form, which aggravate the air pollution situation. Since the industrial centers of Northwestern Bohemia are located in the valley, the conditions for dispersion of the aerosols are extremely unfavorable. In the last 30 years, the number of foggy days in the Most (Brux) Valley doubled. This might be a consequence of the industries emitting condensation nuclei. The critical wind velocity was 3 to 6 m/sec. Such wind velocities prevail in this area 170 days per year.

34605 **APTIC NO. 57573**

Smerdon, Ernest T.

MAN S INFLUENCE ON THE WEATHER. *Public Works, 99(10):102-104, 180, Oct. 1968.*

Weather modification practices, their potential, and related problems are reviewed. Rainfall from winter orographic storms has been increased 10% by selective cloud seeding with silver iodide, and in cumulus clouds, increases of 5 to 20% are obtainable. Cold fog and low stratus clouds consisting of supercooled water droplets have been successfully dissipated over limited areas by seeding with ice, silver iodide, and liquid propane. Presently, there is no proven method for the easy and economical dissipation of warm fog. Proper cloud seeding techniques can also decrease cloud-to-ground lightning and are a great help in reducing forest fires. There will be little evidence that tornadoes can be controlled until an adequate theory of the genesis and behavior of these storms is developed. Theoretically, there is a possibility that hurricanes can be weakened and steered. Experiments are being conducted in hurricane modification, but results have been inconclusive. It has been suggested that air pollution reduces rainfall, due to an overabundance of nucleation particles which cause small raindrops to form that do not coalesce into larger drops and fall as rain. It has also been proposed that pollution increases rainfall where the natural supply of rain forming nuclei is inadequate. It is, therefore, agreed that air pollution will tend to change rain patterns, even though one cannot predict how the changes will occur.

1956

34606 **APTIC NO. 57100**

Monin, A. S.

TURBULENT DIFFUSION IN THE GROUND LAYER OF THE ATMOSPHERE. *Izv. Akad. Nauk. SSSR., Ser. Geofiz., no. 12:1461-1473, 1956. 4 refs. Translated from Russian by A. S. Dyer, United Kingdom Atomic Energy Authority, London (England), Atomic Weapons Research Establishment, 28p., 1963.*

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Solutions of the hyperbolic equation of turbulent flow in the near ground layer of air with indifferent stratification were investigated. As an example, the diffusion of smoke at ambient temperature from a chimney is calculated. The generalized expression from diffusion is indicated for cases with arbitrary temperature stratification of the air. (Author abstract modified)

1951

34607 **APTIC NO. 57101**

Shifrin, K. S.

SCATTERING OF LIGHT IN A TURBID MEDIUM. *(Rasseyaniye Sveta v Mutnoy Srede). Gosudarstvennoye Izdatel stvo Tekniko- Teoreticheskoy Literatury, Moscow-Leningrad, 1951. Translated from Russian. National Aeronautics and Space Administration, Washington, D. C. 215p., April 1968. 128 refs.*

The theory of scattering and absorption of electromagnetic waves in a translucent body is discussed. Among the spheres investigated are clouds, rain, fogs, ice, and dust. If the distance between particles is not very small, the problem may be primarily reduced to scattering by a single particle. The simple analytical formulas which hold for small spheres are presented. The superposition of a diffracted field and the fields of geometric optics apply to large spheres, while the intermediate cases must be tabulated. Simple formulas for nonspherical particles are included. (Author conclusions modified)

BASIC SCIENCE AND TECHNOLOGY

1974

34608 **APTIC NO. 57727**

Gerber, Nathan and Joan M. Bartos

STRONG SPHERICAL BLAST WAVES IN A DUST-LADEN GAS. *Ames Inst. Aeronaut. Astronaut. J., 12(1):120-122, Jan. 1974. 8 refs.*

A simplified treatment of the two-phase flow produced by a spherical blast wave traveling through a uniform dust-laden gas is discussed. The interaction of particles and the effect of the particles on the gas flow are ignored, the problem is reduced to the computation of trajectories of individual dust particles (considered point masses) in a known, unsteady, flow field. To correlate results of trajectory computation, an approximate model which is a further simplification of self-similar flow is used. The resulting closed form solution yields the following: there is a dust layer right behind the shockwave and a dust-free inner core, the ratio of dust layer thickness to shock radius is completely determined by a single parameter combination, and dust particles originally very near the center of the blast overtake and pass the decelerating spherical shock wave. The same treatment is also applicable to a cylindrical blast, taking geometrical differences into account.

34609 **APTIC NO. 57514**

Wilson, W. E., M. C. Dodge, D. N. McNelis, and J. Overton

SO2 OXIDATION MECHANISM IN OLEFIN-NOX-SO2 SMOG. *Preprint, American Chemical Society, 4p., 1974. 6 refs. (Presented at the American Chemical Society, Division of Environmental Chemistry, Los Angeles, Calif., April 1974.)*

The atmospheric conversion of sulfur dioxide to sulfuric acid and various forms of sulfate is an important process in the global sulfur cycle and in determining SO2 and sulfate levels in urban areas. In the presence of olefinic hydrocarbons, nitrogen oxides, and light (i.e., photochemical smog), an indirect photochemical oxidation of SO2 occurs, much faster than direct oxidation of SO2. A reactive intermediary in the gas phase olefin-ozone reactions forms. A simple three-step mechanism, independent of the nature of the intermediate species may be used to model the olefin-ozone-SO2 reactions. The rate of formation of the intermediate, the concentration of the intermediate, the rate of disappearance of SO2, and the constant values can be calculated. Computer-generated plots of data can be compared with experimental data.

1973

34610 **APTIC NO. 57126**

Asakuno, Kunihiko, Masanao Funeshima, and Toshio Odaira

ANALYSIS OF SUBMICRON AEROSOL PRODUCT IN ATMOSPHERE. *(Taikichu ni okeru sabu mikuron erozoru no seisei). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):322, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 68.)*

The measurements of submicron particles were taken by CN counter using oversaturation by adiabatic expansion, and were compared with the weight concentration obtained by light scattering. When weight concentration was high, the number of particles was small. When relatively large particle controlling weight concentration increases, the number of submicron particles decreases. This phenomenon is very much influenced by the behavior of particles produced in the atmosphere and photochemical reactions. The mechanism was studied by producing submicron aerosols and irradiating them by ultraviolet light. The aerosol concentration has the closest connection with the amount of ultraviolet rays in the atmosphere. Sulfur dioxide has almost nothing to do with the formation of aerosol.

34611 **APTIC NO. 57243**

Carlson, D. W., P. Chu, and F. G. Dwyer

A MICRO-ACTIVITY TEST FOR MEASURING LOW TEMPERATURE ACTIVITY OF AUTO EXHAUST CATALYSTS. *Am. Chem. Soc., Div. Petrol. Chem., Preprints, 18(3):467-476, Aug. 1973. 7 refs. (Presented at the Symposium on Catalytic Approaches to Environmental Control, Chicago, Ill., Aug. 26-31, 1973.)*

Rapid screening tests are needed that will reduce the amount of costly pilot plant and full scale catalyst evaluation, especially in the area of automobile emissions control. Since the catalytic oxidation of carbon monoxide and hydrocarbons is highly exothermic, differential thermal analysis (DTA) appears to be a suitable tool for measuring low temperature activity. A rapid sensitive test was developed using a DTA apparatus which gives data that can be interpreted relative to the performance of known and evaluated catalysts. The test can produce semi quantitative evaluations of catalysts and can be used to predict improved or inferior vehicle performance. Test development, reproducibility, and results are described. The microactivity test takes only a short time for evaluation, gives high sensitivity which allows the measurement of small differences in low temperature catalytic activity, and can evaluate very small catalyst samples. In its present state, the test is not suitable for elaborate evaluation of kinetic parameters, and the amount of effort necessary to incorporate the necessary sophistication is not warranted.

34612 **APTIC NO. 57624**

Chien, Chung Jen

NUMERICAL SOLUTION OF A BUOYANT JET IN A CROSS FLOW. *Virginia Polytechnic Inst. and State Univ., Dept. of Aerospace Engineering, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1973, 286p. 18 refs.*

Exact numerical solutions were developed for a three-dimensional, buoyant jet in a cross flow; and the steady state Navier-Stokes Equations written in terms of velocity, vorticity, and temperature with the Boussinesq approximation were used in the computation. Solutions were obtained through the successive over-relaxation iteration method, and a computer program and user s manual associated with several alternate formulations were developed; both uniform and variable spaced grids were employed. Detailed comparisons were made with experimental results for the laminar flow in the entrance region of a square channel in order to test the accuracy of the resulting solutions, and excellent agreement was achieved. A simple eddy viscosity model developed by Prandtl for co-axial jets was utilized with a constant Prandtl number for the turbulent jet in a cross-flow problem, and good agreement with experimental data was found. These equations relate to air flow problems. (Author abstract modified)

34613 **APTIC NO. 57306**

Denisov, V. V., V. A. Taranushich, A. M. Feronov, S. V. Sablin, and V. Yu. Mendel

THERMAL STABILITY OF IRON-CHROMIUM CATALYSTS DESIGNED FOR THE REMOVAL OF SO2 FROM GASES. *(Termicheskaya ustoychivost zhelezokhromovogo katalizatora dlya ochistki gazov ot SO2). Text in Russian. Khim. Khim. Tekhnol., 16(9):1461, 1973. 2 refs.*

The thermal stability of a ferric oxide-chromium oxide catalyst, originally developed for the oxidation of carbon monoxide into carbon dioxide, and now used for the catalytic conversion of sulfur dioxide into sulfur trioxide, was investigated at temperatures of 500, 550, and 600, and 650 C at a SO2 concentration of 0.3% by volume. The catalyst was found to be thermally stable up to a temperature of 650 C. It had maximum efficiency at 500 C, and minimum at 650 C. No drop in the conversion efficiency after 100 hr operation was noted. Short term overheating for less than 3 hr at temperatures above 700 C caused no decrease in the catalytic activity, while long term overheating caused permanent loss of activity. Ferric oxide prevented considerable sulfatization of the chromium oxide.

34614 APTIC NO. 57664

Ganley, John Thomas

PARTICULATE FORMATION IN SPARK IGNITION ENGINE EXHAUST GAS. Michigan Univ., Dept. of Mechanical Engineering, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1973, 150p. 37 refs.

Particulate formation in spark ignition engine exhaust gas was studied by varying the engine speed and load, air-fuel ratio, spark timing, and fuel lead content and determining their influence on particulate weight concentration and size distribution as a function of exhaust gas temperature. The effect of fuel lead content on the chemical composition of the particles was also examined. The results indicated that particulate weight concentration was a function of exhaust gas temperature and fuel lead content. Weight concentration with leaded fuel was approximately three times greater than with unleaded fuel. Particle size distribution was a function of exhaust gas temperature and distance along the exhaust system when using leaded fuel, and this behavior was attributed to growth of particles through condensation of lead halide vapor and deposition of particles on the inner walls of the exhaust system. Particle weight concentration increased at all exhaust gas temperatures as the engine road-load conditions were increased from 40-70 mph; higher operating speed and load resulted in the emission of particles of smaller aerodynamic diameter. Air-fuel ratio and spark timing were not found to have significant effects on particle weight concentration. Particle composition resulting from the use of leaded fuel was a function of exhaust gas temperature and particle size. Particles were primarily composed at temperatures above 750 F, while at temperatures below this value particles consisted of various lead compounds. A method for theoretical calculation of the behavior of the particle weight concentration as a function of exhaust gas temperature was developed, and computations were performed for condensation of both lead halides and high molecular weight organic compounds; the calculated and observed increases in particle weight concentration were found to be in good agreement. (Author conclusions modified)

34615 APTIC NO. 57698

Ivlev, L. S. and S. I. Popova

THE COMPLEX REFRACTIVE INDEX OF THE MATTER OF THE DISPERSE PHASE OF THE ATMOSPHERIC AEROSOL. *(Kompleksnyy pokazatel prelomleniya veshchestva dispergirovannoy fazy atmosferpogo aerozolya). Text in Russian. Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana, 4(10):1034-1043, 1973. 27 refs.*

In the wavelength range of 0.4-15 micron the optical constants are considered of the minerals incorporated in the matter of aerosol particles including sulfates, carbonates, silicates, nitrates, metal oxides, and minerals containing the ammonium cation. The missing data on the complex refractive index of the substances are calculated from the light transmission and reflection spectra using the Kramers-Kroenig method. Taking into account the distribution of chemical elements and the stability of different compounds, the conclusions are made as to the mean refractive indices for each considered class of minerals. Based on the available experimental data on the chemical composition of aerosol particles in the surface layer, the model of the substance of the atmospheric aerosol disperse phase is chosen, and the effective values of the complex refractive index in the absence of free water are calculated. For the visible spectral region, the refractive index equals 1.65 and the constant equals 0.005. The presence of free water in the aerosol particles leads to the decrease of the refractive index.

34616 APTIC NO. 57741

Kallos, G. J. and R. A. Solomon

INVESTIGATIONS OF THE FORMATION OF BIS-CHLOROMETHYL ETHER IN SIMULATED HYDROGEN CHLORIDE-FORMALDEHYDE ATMOSPHERIC ENVIRONMENTS. *Am. Ind. Hyg. Assoc. J., 34(11):469-473, Nov. 1973. 5 refs.*

The vapor phase reaction of formaldehyde and hydrogen chloride in air was studied for the formation of bis-chloromethyl ether. At relatively high concentrations of these reactants (500-3000 ppm), bis-chloromethyl ether was produced at a low ppb level. Bis-chloromethyl ether did not form in detectable amounts when formaldehyde and HCl coexisted in air at concentrations of a few ppm. Even at concentrations higher than the threshold limit values of these materials -- for example, at 100 ppm each -- bis-chloromethyl ether was not formed at a detection limit of 0.1 ppb. Thus, occupational health problems would not be expected from HCl and formaldehyde, since bis-chloromethyl ether is not formed even at concentrations of these reactants significantly above that which humans can tolerate. The vapor phase mixing of formaldehyde and HCl was done at ambient room temperature and relative humidity, and the mixture was allowed to stand for more than 14 hr before analysis. (Author abstract modified)

34617 APTIC NO. 57694

Kirsh, A. A. and I. B. Stechkina

FLOW FIELD AND DIFFUSIONAL PRECIPITATION OF AEROSOLS IN THE SIMPLIFIED MODEL OF A POLYDISPERSE FIBER FILTER. *(Pole techeniya i diffuzionnoye osazhdeniye aerozoley v prosteyshey modeli polidispersnogo voloknistogo fil'tra). Text in Russian. Mekh. Zhidk. Gaz., no. 4:149-155 1973. 7 refs.*

A theoretical and experimental model study of the flow field and diffusional precipitation of aerosol particles on a filter composed of a screen of parallel cylinders with varying diameters placed perpendicularly to the flow direction is described. Viscous flow and small Reynolds numbers were assumed for the investigations. The resistance of screens with a low degree of polydispersity was found to differ slightly from that of corresponding monodisperse screens. Exceptionally strong influences of fiber cylinders with a small diameter on the flow field pattern and diffusional precipitation was observed. Both the fiber resistance and the diffusional precipitation of particles can be calculated from the mean radius of the fiber cylinders, provided the degree of polydispersity of the cylinder diameters is not too high. For a high degree of polydispersity, reduction in the diffusional precipitation of the particles as compared with expectations will occur.

34618 APTIC NO. 57684

Kopczynski, S. L., A. P. Altshuller, and F. D. Sutterfield

PHOTOCHEMICAL REACTIVITIES OF ALDEHYDE-NITROGEN OXIDE SYSTEMS. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., Chemistry and Physics Lab., 42p., 1973, 30 refs.*

Formaldehyde, acetaldehyde, and propionaldehyde were photooxidized in the presence of nitrogen oxides in a reaction chamber irradiated with lamps designed to approximate sunlight. These systems produced similar product yields and biological effects to hydrocarbon/nitrogen oxide systems. At high ratios of reactants, the aldehydes formed yields of oxidants exceeding those produced by hydrocarbons such as propylene, toluene, or m xylene. The oxidant dosages at the 2 to 1 molar ratio of reactants from aldehyde photooxidations with NOx at a 3 ppm and 1 ppm concentration of aldehydes were: formaldehyde, 1.1, 1.0; acetaldehyde, 1.4, 1.3; and propionaldehyde, 3.6, 2.4 ppm/hr, respectively. The major carbon-containing products identified from the ultraviolet irradiation of propionaldehyde-NOx were acetaldehyde, carbon monoxide, and peroxypropionyl nitrate. The major nitrogen-containing organic compounds from this system were peroxypropionyl nitrate, peroxyacetyl nitrate (PAN), and ethyl nitrate; this was 22-58% of the NOx. From 30-46% of the NOx consumed in ultraviolet irradiation of the acetaldehyde-NOx mixture was converted to PAN and methyl nitrate. Propionaldehyde NOx mixtures photooxidized produced substantial levels of eye irritants and phytotoxicants. The eye irritation index increased with molecular weight: propionaldehyde greater than acetaldehyde greater than formaldehyde. Eye irritation response factors in terms of index units/ppm of irritant products were 0.4 for formaldehyde, 1 for PAN, and 7 for peroxypropionyl nitrate. Acrolein was two or three times more irritating than formaldehyde; PAN was intermediate between them; acetaldehyde caused no eye irritation at 5-7 ppm. The average damage to leaf surfaces from 1 ppm of propionaldehyde with 0.60 ppm of NOx was 75%, from 1 ppm of propylene with 0.60 ppm NOx 6%, from an irradiated 2 ppm propylene and 1 ppm NOx mixture 24%, from 1 propionaldehyde and 0.05 ppm NOx 52%. Product yields from photooxidation of formaldehyde-NOx were most sensitive to variation in the ratio of reactants. The yields from the reactions in the system exceeded those of other systems at higher aldehyde-NOx ratios. The photochemical reactivities of the three aldehydes in terms of product yields, eye irritation, and plant damage overlap those of olefinic and aromatic hydrocarbons.

34619 **APTIC NO. 57269**

Kuehn, D. G., S. E. Khalafalla, and L. M. Chanin

IONIC AND NEUTRAL REACTIONS IN GLOW DISCHARGES OF HE-SO2-CO MIXTURE. *Bureau of Mines, Twin Cities, Minn., Twin Cities Metallurgy Research Center, RI 7747, 21p., 1973. 6 refs.*

GPO

Mass spectrographic studies were conducted on the positive ions and neutral species of glow discharges containing 1.0% sulfur dioxide and 1.0% carbon monoxide in helium, with measurements being conducted for gas pressures from 3.5-10.1 torr using both DC and 60 Hz AC excitation. Cationic species (formal charge of plus 1) were observed for the following: sulfur, sulfur oxide, sulfur dioxide, atomic oxygen, molecular oxygen, carbon, carbon monoxide, and carbon dioxide with lesser amounts of several others. Interpretation of the functional dependence of the various ionic and neutral species on pressure and applied power showed that CO reacted with the SO formed in the discharge to produce CO2 and sulfur. Deposition of elemental sulfur was observed in the plasma container. (Author abstract modified)

34620 **APTIC NO. 57127**

Miyai, Shinkichi and Masaki Mori

NO2 CONVERTER ON ATMOSPHERIC CHEMILUMINESCENT NOX ANALYZER. *(Taikichu kemirumi NOx-kei no NO2 combata). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):254, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 9.)*

A nitrogen dioxide converter using carbon was constructed and its performance tested. The reaction is basically dependent on the temperature; therefore, a given concentration of NO2 gas was supplied to the nitric oxide meter at the rate of 1 l/min, and by gradually increasing the temperature of the gas passing the converter, the readings on NO meter were checked. The figures remained approximately constant at 350 C or above, within the limits of 0.1-10 ppm concentration. The converter may be used at this temperature. The conversion rate was measured by supplying dilute NO gas to a chemiluminescence NO meter, and the supply was set so that the NO reading would form a straight line. Then, at a mid-point on the route, an ozone producer was operated and part of NO was oxidized into NO2. The NO reading was reduced. In this state, the gas was switched to the converter circuit, and NO2 was again converted back to NO. The raio of reduction and reconversion will give the conversion rate. Tests using ammonia showed that within the limits of 300-400 C temperature zone, there was almost no influence of ammonia.

34621 **APTIC NO. 57644**

Murdock, David Louis

KINETICS OF THE REDUCTION OF SULFUR DIOXIDE BY HYDROGEN OVER AN ACTIVIATED BAUXITE CATALYST. *Akron Univ., Akron, Ohio, Dept. of Chemical Engineering, Thesis (Ph.D.), Ann Arbor, Mich., Univ., Microfilms, Inc., 1973, 166p. 50 refs.*

The kinetics of the reduction of sulfur dioxide by hydrogen over an activated bauxite catalyst to form elemental sulfur, water, and hydrogen sulfide was studied in order to apply the techniques to the reduction of SO2 emissions from fossil fuel combustion. The reaction was performed in a tubular flow reactor packed with 44.3 g of commercially available activated bauxite catalyst at temperatures of 340-390 C and a total pressure of 775 mm Hg. Feed compositions in mole percent ranged from 1.3-4.0 for SO2 and 2.7-8.0 for hydrogen in a blend with nitrogen diluent. Total flow ranged from 375-1500 std cc/min. Experimental expressions for the initial rate of reaction of each component were determined, and a mechanism involving the adsorption of SO2 to the surface-sulfide site followed by reduction of the adsorbed SO2 with hydrogen was proposed which was consistent with observed initial rate kinetics for all reactants and products. Predicted and experimental conversions of SO2 agreed over the range of 10-98%, although the predicted yields of H2S were approximately half the measured yields when SO2 conversions were greater than 40%. This phenomenon was attributed to an unidentified secondary reaction which was further evidenced by the results of thermodynamic equilibrium computations. (Author abstract modified)

34622 **APTIC NO. 57235**

Pollock, E. N.

TRACE IMPURITIES IN COAL. *Am. Chem. Soc., Div. Fuel Chem., Preprints, 18(4):92-105, 1973. 10 refs. (Presented at the American Chemical Society, National Meeting, 166th, Chicago, Ill., Aug. 26-31, 1973.)*

A spark source mass spectrometer was used to measure six trace elements in coal and wet chemical methods were used to measure 22 elements. Wet and dry ashing of coal were compared to determine if some elements could be lost through volitilization during the combustion process. Agreement between the two sets of data analyzed by atomic absorption spectrophotometry was generally good. However, this only indicates that no copper, manganese, nickel, zinc, cadmium, lead, beryllium, lithium, or vanadium were lost during dry ashing, since these were the only elements tested. Wet chemical methods include: dry ashing, leaching in acid, and analysis by atomic absorption spectrophotometry (ASS) of Li, Be, V, chromium, Mn, Ni, Cu, Zn, silver, Cd, and lead; mercury determination by oxygen bomb combustion followed by flameless AAS; arsenic, bismuth, and antimony analysis by dry ashing and acid dissolution followed by determination of their hydrides using AAS; selenium determination by combustion and cold tapping followed by determination as its hydride using AAS; fluorine analysis by O2 bomb combustion followed by specific ion analysis; and boron determination by dry ashing followed by sodium carbonate fusion, dissolution in dilute sulfuric acid, followed by colorimetric determination with carminic acid.

34623 **APTIC NO. 57726**

Rikhter, L. A., E. P. Volkov, and V. I. Kormilitsyn

THERMAL RISE OF GASES FROM POWER STATION CHIMNEYS. *Thermal Eng. (English translation from Russian of: Teploenergetika), 20(2):70-75, Feb. 1973. 7 refs.*

The plume rise is proportional to the capacity of the heat source and with a given capacity it is independent both of the stack diameter and the velocity of the exit gases and their temperature. There is a substantial dependence of the plume rise on the wind velocity--the thermal rise is inversely proportional to the wind velocity cubed. The thermal rise of the gases increases with fall in the intensity of atmospheric turbulence. The thermal plume rise will differ for the four characteristic conditions of the atmosphere: it will be lowest for the group IV conditions of the earth-adjacent layers of the atmosphere (0.17 less than epsilon less than or equal to 0.27) and highest for the first group (epsilon less than or equal to 0.08). These principles can be used to determine the stack height most effective for the dispersion of waste gases. (Author summary modified)

34624 **APTIC NO. 57643**

Rodriquez-Ramirez, Abraham

THE USE OF OXYGEN-18 TO STUDY THE MECHANISM OF THE OXIDATION OF SULFUR DIOXIDE OVER VANADIUM PENTOXIDE CATALYST. *New York Univ., New York, School of Engineering and Science, Thesis (Ph.D), Ann Arbor, Mich., Univ. Microfilms, Inc., 1973, 226p. 30 refs.*

Oxygen-18 and sulfur-35 were used as tracers to study the mechanism of oxidation of sulfur dioxide over a commercial vanadium pentoxide catalyst. The study was conducted in an all-glass, essentially gradientless reactor operating at about 475 C. The findings indicated that oxygen chemisorption is always the most important rate-controlling step and that it assumes increasing importance with departure from equilibrium. Chemisorption of SO2 and the surface reaction appeared to be very close to equilibrium. Adsorption-desorption of sulfur trioxide accounted for resistance in the sulfur path. This knowledge contributes to SO2 removal technology in relation to stack gases. (Author abstract modified)

34625 **APTIC NO. 57268**

Schehl, R. R. and R. A. Friedel

COMPUTERIZED SYSTEM FOR QUANTITATIVE X-RAY DIFFRACTION ANALYSIS OF PYRITE IN COAL. *Bureau of Mines, Pittsburgh, Pa., Pittsburgh Energy Research Center, TPR 71, 12p., June 1973. 5 refs.*

A computerized system for quantitative x-ray diffraction analysis of pyrite in coal was developed. The analysis can be accomplished in little more than one hour, and this estimate includes sample preparation which could be greatly reduced on a batch basis. Analysis of the scattering intensities is accomplished on a digital computer and requires only a few minutes. Data processing has been completely computerized with pertinent output information displayed on a VR12 cathode-ray tube display. Reproducebility of results appears to be adequate according to ASTM standards except for instances where the coal contains a large amount of mineral matter. An alternative data analysis procedure is being prepared which should improve the accuracy of analysis for pyrite when large amounts of kaolin are present. (Author abstract modified)

34626 **APTIC NO. 57497**

Spence, J. W. and F. H. Haynie

DESIGN OF A LABORATORY EXPERIMENT TO IDENTIFY THE EFFECTS OF ENVIRONMENTAL POLLUTANTS ON MATERIALS. *Preprint, 23p., 1973. 11 refs. (Presented at the American Society for Testing and Materials, Annual Meeting, Philadelphia, Pa., June 25, 1973.*

A five-chambered environmental exposure system was developed to conduct statistically-designed experimentation to investigate the effects of environmental pollutants (sulfur dioxide, nitrogen dioxide, and ozone) on materials. Control of the environmental variables, temperature, humidity, and pollutant concentration, as well as chamber differences in lighting and pollutant distribution, were established to be below 10% variation for 95% of the measurements. Exposure of materials be a dew-light cycle accelerates deterioration as compared to exposure in a constant humidity-temperature environment. To identify the significant effects that the interaction of pollutants and other environment variables have on materials, an evolved two-level fractional factorial design was selected as the statistical experimental tool. (Author summary modified)

34627 **APTIC NO. 56968**

Tohata, Heiichio, Seitaro Kato, and Takeshi Arai

CONTROL TECHNIQUE OF NITROGEN OXIDES. *(Chisso sankabutsu no bojo ni kansuru kenkyu (NO no shokubai sanka kiko ni tsuite no ichi kosatsu)). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):343, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 87.)*

In the wet method of nitrogen oxide control, oxidation of nitric oxide into nitrogen dioxide is important. Experiments with catalytic oxidation using activated carbon are conducted with a high concentration of NO. Here, the oxidation mechanism of a low concentration of nitric oxide by activated carbon was measured by non-dispersive infrared analyzer and chemiluminescence. Nitric oxide was produced by reacting ferrous sulfate and sodium nitrite. The experimental apparatus flow sheet, catalytic conversion rates, and reaction mechanism chemical formulas are presented.

34628 **APTIC NO. 57642**

Wu, Leeyuen

ANISOTROPY OF MICROSCOPIC FLUCTUATIONS OF SUBMICRON-SIZED PARTICLES IN AIR. *Lehigh Univ., Dept. of Physics, Thesis (Ph.D.) Ann Arbor, Mich., Univ. Microfilms, Inc., 1973, 134p. 26 refs.*

Microscopic fluctations of submicron-sized particles in air were investigated by photography at 1, 5, or 10 millisecond intervals in a double-walled chamber. Mean square displacements of particles in the horizontal direction were found to be different from those in the vertical direction for 161 samples of data ranging in size from 207 to 1053, although the cause of the anisotropy was undetermined. No correlation was found between the observed anisotropy and factors such as waiting time after opening the cell hatch, the particle size, position in the cell, frequency of observation, and temperature gradient. An incomplete study, however, suggested a tendency for horizontal fluctations to be more vigorous in the presence of a vertical electric field. Some rare violent fluctuations were observed whether an electric field was present or not, and such fluctuations were larger than Brownian fluctuations expected according to theory. Removal of the large fluctuation from 16 representative data samples reduced the anisotropy to amounts which could be accepted with reasonable confidence limits. (Author abstract modified)

34629 **APTIC NO. 57349**

Yung, David and Ronald F. Probstein

SIMILARITY CONSIDERATIONS IN FACILITATED TRANSPORT. *Massachusetts Inst. of Tech., Cambridge, Mass., Dept. of Mechanical Engineering, Fluid Mechanics Lab., FML-PUB-73-2, 24p., April 1973. 7 refs.*

Similarity parameters are presented for the facilitated transport of a gas through a liquid membrane in which the gas concentration on the downstream side of the membrane is negligible. The membrane facilitation performance depends on three similarity parameters: a dimensionless initial gas concentration on the upstream face of the membrane; a parameter which measures the diffusion rate of the liquid to the backward chemical reaction rate; and one which measures the diffusion rate of the gas to the forward chemical reaction rate. The process is characterized theoretically by a single second order equation. Numerical solutions of this equation are presented. The facilitation characteristics of the membrane are easily mapped out in terms of a dependent parameter which measures the degree of chemical disequilibrium of the system, and a parameter which is a ratio of the total to initial carrier concentration. Simple limiting analytical solutions are given for both the chemical disequilibrium parameter and the carrier concentration ratio parameter, which enables the facilitation performance to be described quite accurately over most of the range of interest. The results compare very well with other available solutions and experiments. This phenomenon has application in the life sciences in the problem of transporting oxygen through a thin film of hemoglobin solution or in the problem of removing carbon dioxide from a life supporting environment using a liquid membrane. (Author abstract modified)

1972

34630 **APTIC NO. 57668**

Bonnot, Anne-Marie and Bernard Cagnac

NUCLEAR RELAXATION OF MERCURY VAPOR BY ADSORPTION ON SOLID SURFACES. *(Relaxation nucleaire de la vapeur de mercure par adsorption sur des surfaces solides). Text in French. C. R. Acad. Sci. Paris, Ser. B, 274(15):947-950, April 10, 1972. 14 refs.*

The influence of various surfaces (different silica glass and metal surfaces) on the nuclear spin relaxation (T) of adsorbed mercury (199) and mercury (201) vapor was studied. The quadrupole interactions on all silica glass surfaces were of the same order of magnitude and exhibited similar temperature dependence; the slope of the curve gave an energy of 0.24 eV. The magnetic relaxation was sensitive to wall treatment and impurities. The magnetic relaxation of Hg (199) on silica glass exhibited a discontinuity at approximately 250 deg in agreement with a silica structure change at this temperature. The slope of the high temperature part of the log (1/T) vs. 1/degree of surface coverage) gave an energy 0.66 eV. The relaxation probability on a W foil was similar. On an evaporated W thin layer, the slope gave an energy of 0.7 eV.

34631 **APTIC NO. 57669**

Gagliardi, J. C.

LEAD IN GASOLINE. *Preprint, American Inst. of Chemical Engineers, New York, 30p., 1972. 25 refs. (Presented at the American Institute of Chemical Engineers National Meeting, 71st, Dallas, Tex., Feb. 20-23, 1972.) (Also: Am. Inst. Chem. Engrs. J., 69(127):162-164, 1973. 19 refs.)*

Currently marketed 91 RON non-leaded fuels are similar in composition to regular leaded fuels and therefore produce exhaust of similar composition and photochemical reactivity. The hydrocarbon emissions and reactivity from a new vehicle which is operated on non-leaded fuel can be expected to increase minimally due to combustion chamber deposits during city suburban driving. The HC emissions and reactivity from a new vehicle which is operated on leaded fuel can be expected to increase as much as 35% due to leaded combustion chamber deposits under the same operating conditions. The HC emissions and HC reactivity of a used vehicle whose engine combustion chambers contain lead deposits from using leaded regular fuel can be expected to decrease by 13% after operating on non-leaded fuels for 6000 miles. In experiments where the olefin content of the fuel was varied between 0-35%, no trends in total HC levels nor HC reactivity were observed, although an increase was observed in the olefin content of the exhaust. In experiments where the aromatic content of the fuel was varied between 15-50%, some data indicate a slight decrease in total HC emissions as aromatic content increased, while other data show no trend. Aromatic aldehydes occur in the exhaust only if aromatic HC were found in the fuel. The PNA content of the exhaust is not related simply to aromatic content, but possibly to some presently unknown precursors. Catalytic exhaust treatment devices, which permit the control of HC reactivity, HC, aldehydes, polynuclear aromatic hydrocarbons, and carbon monoxide to low levels, have a relatively short life with leaded fuel. Lead-derived particles are a major portion of the particulate matter found in the exhaust. (Author summary)

34632 **APTIC NO. 57259**

Mashkina, A. V., P. S. Makoveyev, and N. I. Polovinkina

KINETICS OF THE OXYGEN OXIDATION OF DIMETHYL SULFIDE IN THE PRESENCE OF VANADIUM PENTOXIDE. *(Kinetika okisleniya dimetilsulfida kislorodom v prisutstvii pyatiokisi vanadiya). Text in Russian. Kinetika i Kataliz, 13(1):124-129, 1972. 6 refs.*

The oxidation by oxygen of dimethyl sulfide on a granular vanadium pentoxide catalyst was studied in a temperature range of 175-250 C. The reaction components were 0.045-1.24% of dimethyl sulfide, 1.2-99.2% of oxygen, 0.004-0.1% of dimethylsulfoxide, 0.005-0.12% of dimethylsulfone, 0.013-0.0165% of water, and sulfur dioxide. The rate of dimethylsulfide conversion was varied from 1 to 85%. Water in concentrations over 0.05% by volume, and dimethylsulfoxide in concentrations over 0.08% by volume inhibited the conversion process, while methanol, formaldehyde, and SO2 did not affect the rate of dimethyl sulfide oxidation. The most favorable conditions for the oxidation of dimethylsulfide to dimethylsulfoxide were a temperature range of 160-200 C, and conversion rates below 50%. Under such conditions, the product is easily separated, and only dimethylsulfone is formed as a byproduct. An overall activation energy of 11 kcal/mol, and activation energies of 4.7 + or 1, and 8 + or 1 kcal/mol for the formation of dimethylsulfoxide and dimethylsulfone, respectively, were determined.

34633 **APTIC NO. 57410**

Onischak, Michael

KINETICS OF REGENERATIVE GAS-SOLID REACTIONS IN ENVIRONMENTAL CONTROL. *Illinois Inst. of Tech., Chicago, Ill., Dept. of Chemical Engineering, Thesis (Ph.D), Ann Arbor, Mich., Univ. Microfilms, Inc., May 1972. 169p. 72 refs.*

The kinetics of the following gas-solid systems were studied using a parallel plate reactor: carbon dioxide reacting with solid potassium carbonate, and nitric oxide reacting with solid ferrous sulfate. In both cases, the rates decreased exponentially with time and with temperature, while both sorption rates were apparently adversely affected by excess water vapor. An effectiveness factor of about 100% was calculated for the CO2 system, and the 5% effectiveness factor for the NO sorbent system was consistent with the low ferrous sulfate conversion observed. An earlier investigation of sorption water on pressed lithium chloride was also slightly extended. The rate behavior was similar to the CO2 and NO systems. (Author abstract modified)

34634 **APTIC NO. 57540**

Pilar, Vladimir

INVESTIGATION INTO TECHNOLOGICAL PROPERTIES OF COALS FROM WINNING DISTRICTS UNDER PROJECTION. *(Vyzkum technologickych vlastnosti uhli z novych otvirek). Text in Czech. Ustav pro Vyzkum a Vyuziti Paliv, Prague (Czechoslovakia), Sb. Prednasek 50 (Padesatemu) Vyroci Ustavu Vyzk. Vyuziti Paliv, 1972, p. 38-48.*

Methods of evaluating the quality of reserves of coking coal from the Ostrava-Karvina Coalfield are described. Calculations of reserves were submitted to the KKZ (Commission for Classification of Mineral Reserves). The basic technological evaluation makes use of geological data, especially on the content of ash, sulfur (even of phosphorus), volatile matter, swelling index, dilatometric contraction, and dilatation. From these, a code number and commercial group can be derived. In pilot plant verification of technological feasibility, the quality of coke produced from the coal under investigation or, if necessary, from blends with other kinds of coal, is ascertained. In full-scale verification, the results of preceding stages are confirmed with a test performed at a chosen coking plant. The methods were developed on the basis of many years experience gained in evaluating the 12 mining districts of the Ostrava-Karvina Coalfield.

34635 **APTIC NO. 57263**

Prozorov, Ye. N., M. F. Maslovskiy, and V. A. Budkov

HYDRODYNAMICS NEAR A CYLINDRICAL SURFACE LOCATED IN A FLUIDIZED BED WITH HORIZONTAL PERFORATED BAFFLES. *(Gidrodinamicheskaya obstanovka vblizi tsilindricheskoy poverkhnosti, raspolozhennoy v psevdoozhizhennom sloye s gorizontal nymi perforirovannymi vstavkami). Text in Russian. Khim. Prom. (Moscow), 48(4):298- 300, 1972. 6 refs.*

The hydrodynamics of a fluidized bed of quartz sand near a cylindrical surface was studied by an electrophotometric method, using air as the fluidizing agent. Horizontal perforated baffles with hole diameters of 5, 10, or 15 mm were used. The porosity of the fluidized layer was found to increase due both to the decrease of the rate of ascension of the air bubbles with air flow rate unchanged, and to the use of horizontal perforated baffles in general. Measurements of the contact time of the baffle surface with the gas bubbles showed that the use of reduced-size particles in the fluidized bed leads to a certain increase in the frequency at which the bubbles pass through it but that the latter fails to change with increasing number of baffles within the limits of one fraction of the quartz sand. The use of horizontal perforated baffles also fails to bring about change in the number of bubbles in the fluidized bed. The experimental data obtained can be used to estimate the effect of horizontal perforated baffles on the heat transfer between the fluidized bed and the surface.

34636 **APTIC NO. 57662**

Rudinger, G.

ADDITION OF HEATED SOLID PARTICLES TO A GAS FLOWING IN A PIPE. *J. Basic Eng., 94(1):81-88, March 1972. 15 refs. (Presented at the American Society of Mechanical Engineers, Fluids Engineering Conference, Pittsburgh, Pa., May 9-12, 1971.)*

A number of processes, such as pneumatic conveying of powdered materials through ducts, feed lines for powdered rocket fuels, or certain flow processes in air-augmented solid-propellant rockets, involve addition of a stream of solid particles to a gas flow. The present study deals with the analysis of gas flows from a constant-pressure and temperature reservoir through a pipe into which the particles are injected at some point, and the pipe is assumed long enough to allow equilibrium between the gas and the particles to be established. Ultimately, the mixture is discharged into another reservoir of constant pressure. The temperature of the injected particles may be different from the reservoir temperature of the gas, so that the effects of simultaneous particle and heat addition must be considered. Allowance is made in the flow equations for the volume fraction occupied by the particles, and the analysis may therefore be applied to arbitrarily high particle loadings. To demonstrate the influence of the various parameters involved, the flow equations are solved numerically with the aid of a digital computer. With increasing particle loading the gas flow is markedly reduced, and the temperature of the discharge closely approaches that of the injected particles as a result of the high heat capacity of the particle stream. If this temperature behavior is assumed to hold, simple relationships can be derived which yield results in good agreement with data obtained from the complete equations if the loading ratio equals about ten or more for typical gas-particle mixtures. Of special interest is the finding that the gas flow needed to transport particles at a prescribed rate can be significantly reduced by heating of the particles before injection. Equivalent direct heating of the gas would not be practicable unless the particle loading is quite low. (Author abstract)

1971

34637 **APTIC NO. 56973**

Kaguchi, Akio

FILTER TEST METHOD. *(Koseino ea filruta shikenho). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 8(7):29-31, 1971.*

The test method for the high efficiency particulate air filter (HEPA filter) was developed by the United States Army Chemical Corps and utilizes the principles of light scattering and a DOP (Dioctyl phthalate) test apparatus, comprised of a fan, an aerosol producer, a mixer, and the control and test systems. The particle size measurements are taken by analyzing the intensity ratio of perpendicular, horizontal, and polarized lights created by light scattering against erosol particles. The test apparatus can adjust the temperature, water quantity for the air cooling pipe, the water temperature, the cooled air flow, and the particle sizes. The collection efficiency of filters is measured by passing 0.3 micron single scattering DOP aerosol through the test filter and comparing the aerosol concentration before and after the filter. The apparatus comprises a light scattering chamber, a light source, lenses, a light amplifier, and photometer.

1969

34638 **APTIC NO. 57223**

Duetsch, H. U. and Th. Ginsburg

PARAMETRIC STUDIES ON OZONE PHOTOCHEMISTRY. *Pure Appl. Geophys., 72(1):204-213, Jan. 1969. 12 refs.*

A numerical experiment was made in order to investigate whether it is possible to obtain agreement between photochemical theory and observation of ozone in a pure oxygen atmosphere at levels where near-equilibrium can be expected. Considerable but not unreasonable adjustment of some of the uncertain photochemical parameters such as reaction rates, their temperature dependence, and solar spectral energy distribution, was the solution. It could not be concluded from these results that H-reactions were necessarily of no importance in the stratosphere. However, there was no need to unduly stretch assumptions on some of the parameters involved in the H-reactions in order to obtain agreement between observation and theory.

1968

34639 **APTIC NO. 57227**

Herron, John T. and Robert E. Huie

ON THE REACTION OF ATOMIC NITROGEN WITH CARBON DIOXIDE. *J. Phys. Chem., 72(6):2235-2236, June 1968. 6 refs.*

The reaction of atomic nitrogen with carbon dioxide from 291 to 523 K is reviewed. An easily detectable, rapid, two step reaction was proposed, but results were contradictory. Therefore, atomic nitrogen was generated and passed into carbon dioxide at 330 to 550 K. Partial pressures of atomic nitrogen and carbon dioxide were monitored. The bimolecular reaction was unimportant up to 550 K.

1967

34640 **APTIC NO. 57185**

Camac, Morton and Robert M. Feinberg

FORMATION OF NO IN SHOCK-HEATED AIR. *Combustion Inst., Pittsburgh, Pa., Symp. (Int.) Combust. (Proc.), 11th, Berkeley, Calif., 1966, p. 137-145, 1967. 2 refs. (Aug. 14-20.)*

Chemical changes in shocked air become significant in high-speed flight above Mach 6. The present work presents the determination of the production rate of nitric oxide in shock-heated air. This is an integral-type experiment, in that many reactions proceed simultaneously. The results were compared to calculated NO production rates in air, based on the reaction rate constants compiled by Wray. Nitric oxide production was measured over the temperature range of 2300 to 6000 K. The concentration of NO was determined from the NO infrared emission in the 5.3-micron fundamental vibration rotation band. The main production of nitric oxide was by the reactions oxygen + M equals 20 + M (where M is an atom or molecule), followed by the atomic shuttle reactions O + nitrogen (N2) equals NO + N and N + O2 equals NO + O. In this experiment, the NO production rate was smaller than the rate constants compiled by Wray by a factor of two. In order to explain the disagreement in the rate constant for the reaction N2 + O2 equals 2 NO, the depletion of NO and the reaction products were observed during experiments performed in shock-heated NO. The depletion of nitric oxide occurred through the reaction 2NO equals N2O + O.

34641 **APTIC NO. 57606**

Edmister, Wayne C.

APPLIED HYDROCARBON THERMODYNAMICS. PART 31. IDEAL GAS STATE PROPERTIES. *Hydrocarbon Process., 46(8):119-123, Aug. 1967.*

Heat capacity, enthalpy, and entropy data are tabulated for hydrogen nitrogen, oxygen, carbon monoxide and dioxide, water, hydrogen sulfide, sulfur dioxide, sulfur trioxide, methane, and acetylene. Data for sulfur compounds were obtained. Values of the thermodynamic functions of heat content, free energy, entropy, and heat capacity are based on original statistical-mechanics calculations, with appropriate constants fixed by available experimental data. Sample problems and solutions in which the tables are useful are presented.

34642 **APTIC NO. 57163**

Greig, J. D. and P. G. Hall

THERMAL OXIDATION OF NITRIC OXIDE AT LOW CONCENTRATIONS. *Trans. Faraday Soc., vol. 63:655-661, 1967. 19 refs.*

The thermal oxidation of nitric oxide concentrations of about 50 ppm in nitrogen+oxygen mixtures at 293 K, with oxygen pressures in the range 0.05-175 mm, was investigated by long-path infrared spectrophotometry. Nitrogen was added to give a total pressure of about 630 mm, but some measurements were made at reduced pressure. Measurements were also carried out under simulated atmospheric conditions at 322, 352, and 372 K. At 293 K and total pressure ca 630 mm, the reaction was second order with respect to nitric oxide and first order with respect to nitric oxide and first order with respect to oxygen. The third-order constant, about 35% higher than the accepted value for higher concentrations of nitric oxide, agreed closely with the value previously obtained under simulated conditions. It was independent of both the total pressure and the pressure of nitrogen. This work also confirmed that the higher value of k at very low concentrations of nitric oxide is due to an increase in the nitrogen+oxygen frequency factor. At low concentrations of nitric oxide the structure of the activated complex conforms more closely to the transition state model than at higher concentrations. Changes in the activated complex s partition function will influence the frequency factor, which is approximately equal to the rate function.

34643 **APTIC NO. 57388**

McEwan, M. J. and L. F. Phillips

RADICAL CONCENTRATIONS AND DECAYS IN LEAN HYDROGEN-NITROGEN- OXYGEN FLAMES. *Combustion Flame, 11(1):63-70, Feb. 1967. 26 refs.*

The consequences of having atomic oxygen and molecular oxygen present as constituents in hydrogen-nitrogen-oxygen flames were studied by lithium hydroxide photometric methods, modified to use atomic absorption rather than emission spectrophotometry. Concentrations of hydroxide O, and O2 in oxygen-rich flames were calculated from the LiOH results for hydrogen concentration with the equilibrium constant expressions of Kaufman and Del Greco; the concentrations of O and OH in stoichiometric flames were determined by the iodine oxide and sodium hydroxide methods respectively. Results indicate that the reactions involving atomic oxygen are not an important mode of recombination. In oxygen-rich flames, the product of hydrogen concentration and oxygen-hydrogen concentration was always larger than oxygen concentration, and the rate constants for thermolecular recombination of H and OH were about two orders of magnitude larger than those for recombination of oxygen atoms. Recombination by way of H + OH + M equals water + M will be a major mode of radical decay in these flames, and that direct three-body recombination of oxygen atoms is unimportant, where M is hydrogen, nitrogen, water, or a metal.

34644 **APTIC NO. 57392**

Morecroft, M. J. and J. H. Thomas

THE REACTION BETWEEN NITRIC OXIDE AND OXYGEN. *J. Phys. Chem., 71(5):1543-1544, April 1967. 3 refs.*

Examination of the reaction 2 nitric oxide + oxygen yields 2 nitrogen dioxide at 478 K; to a lesser degree, at 529 and 539 K, a constant value of km or kp was indicated with varying NO and O2 pressures. The addition of nitrogen did not cause a marked decrease in the initial reaction rate. These results support the view of Ashmore, Burnett, and Tyler that the reaction kinetics of the equation are third order and that addition of nitrogen has no inhibiting effect.

34645 **APTIC NO. 57387**

Patrick, M. A.

EXPERIMENTAL INVESTIGATION OF MIXING AND FLOW IN A ROUND TURBULENT JET INJECTED PERPENDICULARLY INTO A MAIN STREAM. *J. Inst. Fuel, 40(320):425-432, Sept. 1967. 27 refs.*

Traverse jet testing, undertaken to measure the constant static pressure through the jet and similarities in the profiles of the velocity downstream at the nozzle, and at successive sections, was carried out in a simple wood tunnel. Stream air, supplied from a fan, gave a uniform velocity profile across the duct and provided a main stream whose velocity was continuously variable up to approximately 25 ft/sec. Velocity measurements were obtained with a modified pitot tube, used in conjunction with a mechanical traversing system and semi-automatic recording instrument. Readings of the nozzle fluid concentration were taken over a network of points in the mixing region, and the Schlieren technique employed in flow visualization allowed the broad pattern of the flow to be recorded by camera. Photographs revealed the following: The jet as it leaves the nozzle has an almost uniform velocity profile across its width; the undisturbed main area also has a uniform distribution of velocity, plus a low turbulence level. Similarities between successive sections of the jet were not found. Since the degree of similarity diminishees as the relative stream to jet velocity is increased, it will be difficult to arrive at a mathematical solution of the system. Current theoretical explanations of the entrainment theory do not accurately represent the turbulent jet flow.

34646 **APTIC NO. 57283**

Wilson, W. E.

RATE CONSTANT FOR THE REACTION N + O2 YIELDS NO + O. *J. Chem. Phys., 46:2017-2018, 1967. 6 refs.*

Nitrogen atoms were generated by microwave discharge in nitrogen, and their concentration was monitored by electron spin resonance. The N atom signal was measured both with and without oxygen flow, and the logarithm of this ratio was plotted as a function of reaction distance, the slope being directly related to the rate constant for N decay at furnace temperature. The technique of data analysis described cancels the effect of N-atom loss by any first order process (mainly wall recombination) other than reaction with O2. It also permits the atom detection cavity to be located outside the furnace.

1966

34647 **APTIC NO. 57580**

Beer, J. M.

THE SIGNIFICANCE OF MODELLING. *J. Inst. Fuel., 39(310):466-473, Nov. 1966. 40 refs. (Presented at the Third Symposium on Flames and Industry, Oct. 19, 1966.)*

The complexity of technological problems such as the combustion and heat transfer from flames in furnaces often requires experiments on prototypes. As the physical chemical processes involved are not fully understood, similarity rules need to be established for the application of the results so obtained. Methods of establishing similarity by dimensional analysis and from the fundamental differential equations are discussed. The modeling of different aspects of the process usually requires incompatible similarity rules to be obeyed. Full similarity between model and prototype is, however, not necessary. It is argued that sound knowledge of the underlying processes coupled with the ingenuity of the experimenter enables successful partial modeling. Such a model may be incomplete and reproduce faithfully only those aspects of the prototype which are considered of primary importance. Similarity rules which can be relaxed for combustion modeling are mentioned as examples. Criteria of isothermal modeling of turbulent jet flames in combustors and furnaces are discussed, togethtr with flow visualization and quantitative modeling techniques.

34648 **APTIC NO. 57255**

Yepifanov, V. S. and T. I. Kunin

EFFECT OF WATER VAPOR ON REACTION OF SODA WITH SULFUR DIOXIDE AT TEMPERATURES ABOVE 100 C. *(K voprosu o vliyanii parov vody na protsess vzaimodeystviya sody s sernistym angidridom pri temperaturakh vyshe 100 C). Text in Russian. Izv. Vysshikh Uchebn. Zavedenii Khim i Khim. Tekhnol., no. 5:785-790, 1966. 7 refs.*

Soda preheated to 150 C with steam will then react with sulfur dioxide in the absence of water vapor at temperatures above 120 C. Similar activity is exhibited by soda freshly produced from sodium bicarbonate in the 140-200 C range. Such so-called activated soda is deactivated by exposure to moisture at low temperatures or when heated to above 200 C. The activated soda is more amorphous, with incomplete structure, and contains sodium carbonate. The mechanism of water vapor participation in production of sodium sulfate by the so-called dry method from soda and sulfur dioxide was also studied. Steam hydrolysis of the soda is the limiting stage in this process.

1965

34649 **APTIC NO. 57604**

Frisch, Margaret A. and John L. Margrave

THE HEAT OF FORMATION OF NITRIC OXIDE(G). *J. Phys. Chem., 69(11):3863-3866, Nov. 1965. 25 refs.*

The reaction, nitirc oxide + carbon monoxide yielding nitrogen + carbon dioxide, was carried out in an illium bomb and calorimetrically measured. Purified NO and CO were introduced into the bomb until 5.5 and 12.1 atmospheres were reached, respectively. Reaction gases were flushed through a series of absorption tubes, and the number of CO2 moles formed was used as the measure of the reaction. From heat reaction data, the standard heat of formation of NO at 298.15 K was established as 21.556 + or 0.06 kcal/mole.

34650 **APTIC NO. 57102**

Shifrin, K. S. and A. Ya. Perel man

SPECTRAL TRANSPARENCY OF ALMOST MONODISPERSED SYSTEMS. *(Spektral naya Prozrachnost pochti Monodispersnykh sistem). Tr. Gl. Geofiz. Observ. (Leningrad), no. 170:37-60, 1965. 6 refs. Translated from Russian. Air Force Systems Command, Wright Patterson AFB, Ohio, Foreign Tech. Div., 35p., Nov. 1967.*

NTIS: AD-675577

The effect of the parameters of polydispersion, particularly the width of distribution delta r, on the transparency of the system was investigated. It was assumed that the particle size (radii) spectrum is described by a gamma distribution and the scattering cross section is an arbitrary analytic function whose argument is proportional to the product rv (v is the wave number). An expression is derived for the optical characteristics of almost monodispersed systems. The range of applicability of these formulas is evaluated. Calculations are presented which illustrate details of the spectral structure of transparency as the distribution width is narrowed. The connection between dimensionless characteristics of transparency for different linear scales is established, and a formula is derived for determining transparency when the linear scale is changed. Curves of the spectral transparency of different polydispersed systems are presented to illustrate the application of the formulas.

1964

34651 **APTIC NO. 57583**

Mellor, J. W.

OTHER REACTIONS OF NITRIC OXIDE. *In: Treatise on Inorganic and Theoretical Chemistry, vol. 8, Suppl. 2 (Part II), London, Longmans, Green and Co., Ltd., 1964, p. 233-240. 120 refs.*

The reactions of nitric oxide are reviewed and reaction mechanisms are suggested. Nitric oxide reactions with nitrogen trichloride, ammonia, oxides and oxy-acids of sulfur, sulfur dioxide, or sulfurous acid are included. Reactions with alkali metal hydroxides are of considerable importance, as these are frequently used to remove higher oxides of nitrogen from nitric oxide. With aqueous potassium hydroxide some nitrogen is formed. With solid potassium, sodium, cesium, lithium, calcium, strontium, and barium hydroxides at room temperature, both nitrous oxide and nitrogen are formed.

1963

34652 **APTIC NO. 57159**

Galwey, A. K.

THE REACTIONS OF NICKEL CARBIDE WITH A NUMBER OF HYDROGEN- CONTAINING OR OXYGEN-CONTAINING GASEOUS COMPOUNDS. *J. Catalysis, 2:176-188, 1963. 17 refs.*

The kinetics of reaction of nickel carbide with a number of gases which contain hydrogen and/or oxygen have been studied in the temperature range 200 to 500 C. The results can be classified as showing evidence of three main types of reaction. The first has no reaction below the temperature at which nickel carbide decomposes. Both carbon dioxide and ammonia showed this type of behavior; the latter reacted above 400 C with the products of the thermal decomposition of the carbide to form methane. The second reaction occurred in the temperature range 200 to 350 C to give a mixture of a small number of gaseous products (for example CH4, CO2, and carbon monoxide) by a reaction in which the rate was proportional to pressure of the reactant gas and the weight of unreacted carbide. Reaction of water vapor and sulfur dioxide showed this behavior. The cracking of ethane was also included in this class though reaction rate did not decrease with time. It was believed that the carbide phase was regenerated during the reaction. The third reaction gave a complex mixture of products, and kinetics showed evidence of two periods of reaction, and initial deceleratory process followed by a long slow main reaction period, which is believed to occur at a solid-solid interface. Reactions of hydrogen chloride and of hydrogen sulfide with nickel carbide were examples of this type of behavior. Mechanisms are proposed to account for the reactions of each of the gases studied with nickel carbide. (Author abstract modified)

34653 **APTIC NO. 57099**

Mikkaui, M. F. K.

NATURE OF BROWN FUMES FORMED DURING THE BLOWING OF OXYGEN THROUGH METAL. *Izv. Vysshikh. Uchebn. Zavedenii, Chernaya Met., no. 11:37-41, 1963. 8 refs. Translated from Russian. British Iron and Steel Industry Translation Service, London, (England), 8p., Jan. 1968.*

The nature of the brown fumes formed during the blowing of oxygen through metal in steel making was investigated. The particles were caught on fiberglass filters and examined with x-rays. The composition depends on the nature of the gas flown, being ferric oxide in oxidizing atmospheres, iron oxide, black, (Fe3O4) in inert, and ferrous oxide in reducing atmospheres. The vapor pressure of Fe2O3 is negligible and that of Fe2O4 exceeds those of iron or FeO so that vaporization of Fe3O4 is the primary process. (Author abstract modified)

1962

34654 **APTIC NO. 57165**

Ashmore, P. G., M. G. Burnett, and B. J. Tyler

REACTION OF NITRIC OXIDE AND OXYGEN. *Trans. Faraday Soc., vol. 58:685-691, 1962. 15 refs.*

The reaction between nitric oxide and oxygen in the presence of varying pressures of nitrogen was studied over a temperature range of 104 C to 506 C. Cylindrical quartz vessels heated in an electric furnace were used to carry out the reactions which were followed by measurement of the nitrogen dioxide formed. The effect of adding nitrogen was investigated in detail at 360 C using 100 mm of nitric oxide, 50 mm of oxygen, and 0 to 400 mm of nitrogen. Neither the addition of varying pressures of nitrogen nor the manner of mixing the gases altered the constant rate of reaction. These results are in direct opposition to previously reported data which predict that the initial reaction rate would be halved with the addition of 100 mm of nitrogen. The kinetics of the reaction were discussed in detail, and the possible role of NO3 as an intermediate in the reaction was considered.

1961

34655 **APTIC NO. 57543**

Ashmore, P. G. and M. G. Burnett

CONCURRENT MOLECULAR AND FREE RADICAL MECHANISMS IN THE THERMAL DECOMPOSITION OF NITROGEN DIOXIDE. *Trans. Faraday Soc., vol. 58:253-261, July 1961. 14 refs.*

The kinetics of the thermal decomposition of nitrogen dioxides were studied at temperatures between 200 C. and 434 C. The results are quantitatively presented with the concurrent molecular and free radical mechanism. Expressions for the rate constants k1 and k2, and for the composite constant k2k4/k3, were experimentally determined from published data, expressions were derived for k3, k4, and the constant k(-4) of the reverse final reaction.

34656 **APTIC NO. 57097**

Davtyan, O. K, Ye. N. Ovchinnikova, and G. A. Grigor eva

CATALYTIC ACTIVITY OF PLATINIZED NICKEL IN RELATION TO OXIDATION OF SO2. *Nauchn. Ezhegodnik Odessk. Gos. Univ. Khim Fak., no. 2:115-116, 1961. 1 ref. Translated from Russian by William C. Hunn, Tennessee Valley Authority, Oak Ridge, Wilson Dam, Ala., 3p., March 1968.*

NTIS: PB-178110-T

The activity of a platinum catalyst in a porous nickel skeleton was compared with the activity of a platinized asbestos. The comparison was performed according to the percentage of reacted sulfur dioxide with all other conditions remaining equal. The relationship of percent yield to temperature was in the range of 150-550 C. At 400 C there is a 93% yield of sulfur trioxide from platinized asbestos, while platinized nickel peaks at 300 C with an 84% yield.

34657 **APTIC NO. 57153**

Kunin, T. I. and V. S. Yepifanov

REACTION OF SODA WITH SULFUR DIOXIDE IN A BOILING LAYER. *(K voprosu o vzaimodeystvii sody s sernistym angidridom v kipyashchem sloye). Text in Russian. Izv. Vysshikh Uchebn. Zavedenii Khim. i Khim. Tekhnol., 4(6):992-997, 1961. 11 refs.*

A process for obtaining sodium sulfite by the so-called dry method in a boiling (semisuspended) layer is described. Concentration of water vapor in the gaseous phase and process temperature have a strong influence on the rate of absorption of sulfur dioxide by the soda. An increase in water vapor concentration leads to increased absorption rate (at low temperatures up to 50 deg) and to increased oxidation rate of the sulfite salts in the presence of oxygen. Above 100 deg, water vapor concentration has less effect and sulfite oxidation rate drops sharply. Sulfur dioxide absorption rate exhibits a minimum at about 50 deg. The concentration of SO2 in the gas and the linear velocity of the gas has negligible effect on process rate. Gas diffusion with particles of the solid phase is a limiting factor.

1960

34658 **APTIC NO. 57152**

Koval, E. J. and M. S. Peters

HOW DOES NITRIC OXIDE AFFECT REACTIONS OF AQUEOUS NITROGEN DIOXIDE? Ind. Eng. Chem., 52(12):1011-1014, Dec. 1960. 23 refs.

The influence of nitric oxide on the production of nitric acid and on the kinetics and mechanisms involved in the absorption of nitrogen oxides into water was studied in demineralized water in a wetted-wall column at room temperature and atmospheric pressure. Gaseous nitrogen dioxide and nitric oxide were mixed with nitrogen as the diluent. Nitrogen flow rates were measured by a calibrated venturi meter; NO flow rate was measured with a calibrated capillary tube. A capillary tube also set the approximate flow rate of nitrogen dioxide. Evacuated Gaillard bulbs were used for taking inlet and outlet gas samples. Liquid samples were collected under a sodium hydroxide solution. The resultant mixture of sodium nitrate, sodium nitrite, and excess sodium hydroxide was back-titrated to determine the original total acid content. It was observed that NO increased nitrous acid, decreased nitric acid, decreased total acid, removed NO, and changed only slightly the removal rate of NO2. Equations were developed for calculating the aqueous absorption rate of nitrogen oxides, the disappearance rate of NO and NO2, and the stoichemistry involved in the reactions of nitrogen tetraoxide (N2O4) + H2O and nitrous anhydride (N2O3) + H2O.

1959

34659 **APTIC NO. 57253**

Yuan, Edward L., John I. Slaughter, William E. Koerner, and Farrington Daniels

KINETICS OF THE DECOMPOSITION OF NITRIC OXIDE IN THE RANGE 700-1800 C. *J. Phys. Chem., 63(6):952-956, June 1959. 17 refs.*

The decomposition rate of nitric oxide was measured over a wide temperature range and under a variety of experimental conditions in three investigations, each involving decomposition in a refractory tube, packing with refractory pellets, and heating in an electric furnace, followed by chemical analysis or light absorption of the nitrogen dioxide produced. In all three studies the decomposition rate was zero order, homogeneous, and surface-catalyzed from 700 to about 1100 deg. At temperatures above 1400 deg, the reaction was second order and required a larger energy of activation. Between 1100 and 1400 deg the reaction was partly homogeneous and partly heterogeneous. Above 1800 deg another mechanism with a still higher activation energy may apply; but experiments could not be carried out in this range. Packing of refractory pebbles assured rapid attainment of the reactor temperature and made possible complete mixing and uniform gas flow across the whole area of the reaction tube. This reaction is particularly suitable for kinetic measurements by the flow methods.

1957

34660 **APTIC NO. 57189**

Fenimore, C. P. and G. W. Jones

NITRIC OXIDE DECOMPOSITION AT 2200-2400 K. *J. Phys. Chem., 61(5):654-657, May 1957. 4 refs.*

Flat premixed flames of nitrous oxide and fuels (hydrogen or carbon monoxide) were burned at controlled temperatures on a water-cooled porous burner. The burner was sintered copper with a cooling coil attached, and the temperature was controlled by regulating the gas flow. The nitrous oxide decomposed entirely in the flame, partly to nitric oxide, and the subsequent decay of nitric oxide in the burned gas downstream was observed with a probe connected to collecting bottle under a vacuum. Analysis was done by mass spectrometry. The decay was observed to be second order in nitric oxide, impeded by oxygen. The range of variables was oxygen equal to 10 to the -3 power to 10 to the -7 power moles/l and NO/O2 equal to 0.5 to 2000. Zeldovitch obtained experimental results in a different manner which agree, but his proposed mechanism must be modified.

1956

34661 **APTIC NO. 57685**

Bretsz ajder, S., W. Bacia, and W. Kawecki

ABSORPTION OF SULFUR DIOXIDE IN SOLUTIONS OF BASIC ALUMINUM SULFATE-VIII. ABSORPTION IN A PACKED COLUMN. *(Absorpcja dwutlenku siarki w roztworach zasadowego siarczanu glinowego. VIII. Absorpcja w kolumnie wypetnionej). Text in Polish. Przemysl Chem., vol. 35:83-86, 1956. 5 refs.*

In a column filled with Raschig s rings, the absorption rate of sulfur dioxide in a basic aluminum sulfate solution was measured. The absorption rate was determined by the mass transfer coefficient of the liquid film; the liquid film offers the main resistance to sulfur dioxide diffusion. Absorption of sulfur dioxide in the packed column was compared with its absorption in an empty, wet-walled column. The liquid film coefficient in the empty column was three times that in the packed column, and the gas-film coefficient was one-tenth as high.

34662 **APTIC NO. 57385**

Sleicher, Charles A. and Stuart W. Churchill

RADIANT HEATING OF DISPERSED PARTICLES. *Ind. Eng. Chem., 48(10):1819-1824, Oct. 1956. 12 refs. (Presented at the American Chemical Society, 129th Meeting, Dallas, Tex., April 8-13, 1956.)*

When a dispersion of solid or liquid particles in air, such as a spray, smoke, or fog, is subjected to a radiant flux, energy is absorbed by the particles, the temperature of the particles rises, and energy is transferred from the particles to the air. If the particles have an appreciable vapor pressure, mass is also transferred to the gas phase. An approximate equation is developed for the temperature history of a dense dispersion of nonvolatile particles. The solution encompasses the initial period, the pseudo-steady state period, and the final period when the effect of adjacent particles is significant. The equations are reasonably accurate for a dispersion of small particles exposed to a radiant flux. Temperature differences within the particles are generally negligible. The temperature of nonvolatile droplets rises rapidly to a pseudo-equilibrium value and finally rises more slowly as the finite amount of air associated with each particle is heated by conduction. Evaporation decreases the temperature of volatile droplets throughout the process, and for sufficiently volatile materials the temperature may remain below ambient. The radiant energy absorbed by small particles is rapidly transferred to the vapor phase by conduction or evaporation. It is not possible to heat the particles to their ignition point without first raising the temperature of the surrounding air.

34663 **APTIC NO. 57574**

Stephens, Edgar R., Philip L. Hanst, Robert C. Doerr, and William E. Scott

REACTIONS OF NITROGEN DIOXIDE AND ORGANIC COMPOUNDS IN AIR. *Ind. Eng. Chem., 48(9):1498-1503, Sept. 1956. 13 refs.*

The photochemical reactions of ozone and nitrogen dioxide with hydrocarbons, together with their oxidation products, were analyzed by infrared absorption spectroscopy. It was assumed that a knowledge of these reaction rates and mechanisms would contribute to an understanding of the smog problem. Experiments were carried out in a reaction vessel containing a borosilicate-glass window through which the reaction mixture was exposed to radiation from a carbon arc. Blank infrared spectra taken after the cell was filled with oxygen showed water vapor, carbon dioxide, small amounts of hydrocarbon (chiefly methane), and traces of nitrous oxide. Nitrogen dioxide was estimated at 6.2 micron near the center of the water band. Spectra of the reactants and products in the reaction of nitrogen dioxide and 2-methylheptane indicated the ozone band at 9.6 micron. Bands of solid nitrate and alkyl nitrate were also apparent. A substantial amount of nitrogen dioxide was still present after 135 min of radiation. Ozone formed in a reaction between 20 ppm of 3-methylheptane and 4 ppm of nitrogen dioxide in 1 atmosphere of oxygen with a carbon arc light source and infrared path length of 324 m. Ozone did not disappear by reaction with nitric acid to form nitrogen dioxide, though it did disappear at moderate rates after ultraviolet radiation had stopped. Other findings indicate an upper limit for nitrogen dioxide concentration above which ozone is not produced within a limited irradiation time, and the increase in this limit by hydrocarbon concentration.

1955

34664 **APTIC NO. 57166**

Daniels, Farrington

NITROGEN OXIDES AND DEVELOPMENT OF CHEMICAL KINETICS. *Chem. Eng. News, 33(23):2370-2373, June 6, 1955.*

Knowledge of the kinetics of nitric anhydride (nitrogen pentoxide), whose rate of decomposition is nearly the same in inert solvents as in the gas phase, where vacuum is the solvent, bridges the gap between gas kinetics and solution kinetics. The many consecutive, competing, and reverse reactions which comprise the reactions of the nitrogen oxides are simple, unimolecular and bimolecular reactions which, in principle, can be predicted in simple terms. Fundamental research on the chemical kinetics of these oxides may one day be applied to new industries and new technologies. It is now possible to calculate not only the decomposition rate of nitric oxide, but also the rate of formation of nitric oxide from nitrogen and oxygen at any temperature. Practical implications extended from nitric acid manufacture to smog produced by automobile exhaust gas, to phenomena connected with aboveground atomic explosions, and to the fixation of atmospheric nitrogen. A new approach to the fixation of nitrogen is the thermal (Wisconsin) process, involving the catalytic oxidation of nitric oxide and the adsorption of nitrogen dioxide by silica gel. Currently, it cannot compete economically with the Haber process, but a new use for nitrogen oxides in low concentration or a less expensive recovery system than that based on silica gel could make it economically feasible.

34665 **APTIC NO. 57191**

Nandi, S. P., K. A. Kini, and A. Lahiri

ADSORPTION OF POLAR GASES BY ANTHRACITE. *Fuel, vol. 34-35:133-134, 1955-56. 2 refs.*

Data are presented for the adsorption of sulfur dioxide, hydrogen chloride, and methylamine by anthracite. The descending order of adsorption is hydrogen chloride, methylamine, and sulfur dioxide. The most important features of the adsorption are its slowness (10 to 20 hr/for equilibrium)/and its irreversibility. The gases undergo chemisorption or enter into chemical combination with the anthracite, and that oxygen is chiefly present in a form of a quinone. Calculations give a value of 1% for the oxygen present in anthracite.

34666 **APTIC NO. 57588**

Treacy, John C. and Farrington Daniels

KINETIC STUDY OF THE OXIDATION OF NITRIC OXIDE WITH OXYGEN IN THE PRESSURE RANGE 1 to 20 MM. *J. Am. Chem. Soc., 77(8):2033-2036, April 30, 1955. 12 refs.*

The rate of the reaction 2 nitric oxide + oxygen yields 2 nitrogen dioxide was measured from 1 to 20 mm at 0, 25, and 65 C using the absorption of light by NO2. The order with respect to NO was slightly greater than two, and the order with respect to oxygen was one or slightly less. At higher pressures these orders tended to become two and one. Inert gases, surfaces, and temperature had little influence on the reaction. The specific rate was slower at the beginning of the reaction and was slightly decreased by NO2 addition. A mechanism and a rate expression are proposed.

1952

34667 **APTIC NO. 57281**

Wise, Henry and Maurice F. Frech

KINETICS OF DECOMPOSITION OF NITRIC OXIDE AT ELEVATED TEMPERATURES. II. THE EFFECT OF REACTION PRODUCTS AND THE MECHANISM OF DECOMPOSITION. *J. Chem. Phys., 20(11):1724-1727, Nov. 1952. 11 refs.*

The effects of the reaction products, nitrogen and oxygen, on the kinetics of decomposition of nitric oxide were studied. The kinetics of decomposition exhibited predominantly a heterogeneous mechanism at 1000 K and a homogeneous mechanism at 1600 K. Aliquots of uniform gas mixtures of known composition with respect to nitric oxide and nitrogen or oxygen were subjected to decomposition in a quartz reactor. The extent of the reaction was determined quantitatively by manometric analysis for nitrogen and spectrophotometric analysis for nitrogen dioxide. At a reaction temperature of 980 K, nitrogen had a marked retarding influence on the transformation of nitric oxide, but the reaction rates appeared insensitive to the partial pressure nitrogen in spite of a tenfold variation in initial concentration. The kinetics of the reaction followed a second-order rate law. Partial poisoning of the surface by nitrogen is suggested by the results. In contrast, the addition of oxygen resulted in a marked increase in the rate of decomposition of NO at a temperature range from 980 K to 1912 K. At high concentrations of oxygen the following rate equation was found: -d(NO)/dt equals k sub a(NO) + k sub b(NO)(O2) to the 1/2 power; activation energy for the rate-determining step was 78.2 kcal. From the observed results, a mechanism was proposed involing a chain propagated by the atomic species formed in the reaction.

34668 **APTIC NO. 57282**

Wise, Henry and Maurice F. Frech

KINETICS OF DECOMPOSITION OF NITRIC OXIDE AT ELEVATED TEMPERATURES. I. RATE MEASUREMENTS IN A QUARTZ VESSEL. *J. Chem. Phys., 20(1):22-24, Jan. 1952. 9 refs.*

The rate of thermal decomposition of nitric oxide was measured in a quartz vessel over a temperature range of 872 K to 1275 K. The rate of product formation was used as an index of reaction rate. Nitrogen concentration was determined manometrically; oxygen concentration was measured by spectrophtometric analysis for nitrogen dioxide, which formed at room temperature from oxygen and unreacted nitric oxide. The rate of NO decomposition followed a second-order rate law over the temperature range studied. Hovever, variations in the surface-to-volume ratio of the reaction vessel indicate a predominance of a heterogeneous mechanism at 1000 K, whereas at temperatures 1400 K the homogeneous rate far exceeds the heterogenous one. In the temperature range of 1100 K to 1400 K, both mechanisms play an important role in the over-all reaction kinetics. Activation energy approaches a limiting value of 21.4 kcal at 900 K; above 1600 K the effective activation energy is 82 kcal.

1951

34669 **APTIC NO. 57190**

Owen, A. J., K. W. Sykes, and D. J. D. Thomas

THERMODYNAMICS OF CARBON DISULPHIDE SYNTHESIS. EQUILIBRIUM IN SOME REACTIONS INVOLVING SULPHIDE, SULPHUR DIOXIDE, CARBON DIOXIDE AND CARBON. *Trans. Faraday Soc., vol. 47:419-428, 1951. 8 refs.*

Thermodynamic calculations were made for the following systems: (a) carbon dioxide + hydrogen sulfide; (b) CO2 + 2H2S + carbon; (c) 2H2S + C; and (d) sulfur dioxide + C. The composition which each system would react at equilibrium is defined in terms of the least number of independent equilibrium constants which must be satisfied simultaneously. Solutions are then found by successive approximation for a total pressure of 1 atm at temperatures of 1000, 1200, and 1400 K. In system (a), the equilibrium conversion of H2S to carbon disulfide is less than 0.4% throughout the temperature range investigated. It is much greater, however, in the presence of carbon, and in system (b) it rises from 4.6% at 1000 K to 47.8% at 1400 K. As far as the yield of CS2 is concerned, there is little difference between systems (b) and (c). Although both reactions are highly endothermic, much less heat is absorbed in the production of 1 mole of CS2 in (c) than in (b). Better thermodynamic prospects for carbon disulfide synthesis are offered by the reaction of H2S with carbon in the presence of oxygen or air. The reaction of SO2 with carbon gives the best yield of CS2, i.e., 37.1% at 1000 K and 81.2% at 1400 K, but its endothermicity is intermediate between those systems (b) and (c). There does not appear to be any thermodynamic basis for the view that when SO2 is passed over carbon, little CS2 is obtained unless the temperature is about 200 C higher in the middle of the carbon column than at the ends. (Author abstract modified)

1950

34670 **APTIC NO. 57580**

Crawford, V. A. and F. C. Tompkins

THE ADSORPTION OF GASES ON CALCIUM FLUORIDE. *Trans. Faraday Soc., vol. 46:504-514, 1950. 13 refs.*

The adsorption of sulfur dioxide, nitrous oxide, and carbon dioxide on calcium fluoride crystals was measured at -28.8, 0.0, 19.4, and 35.5 C. Measurements were considered in terms of the nonuniformity of the adsorbent surfaces. Net heat of adsorption and distribution of adsorption sites were described by the Brunauer-Temkin, Freundlich, and De Boer-Bradley-Palmer isotherms. Analysis showed that SO2 on CaF2 will obey the De Boer-Bradley-Palmer equation over a wide range of pressures. The Freundlich equation is more satisfactory for the non-polar gases. Distribution of sites is affected by the nature of adsorbate-adsorbent forces, not by the nature of the non-uniformity of the solid adsorbent alone. Electrostatic forces predominate in the adsorption of a highly polar adsorbate. The edges and corners of the crystal will be low energy sites. Dispersion forces are important in the adsorption on non-polar gases. The edges and corners will be high energy sites.

1949

34671 **APTIC NO. 57104**

Fuks, N. A.

DETERMINATION OF DROPLET SIZE IN OIL FOGS. *Colloid J. (USSR) (English translation from Russia of: Kollaidu Zh.), 11(4): 280-282, 1949. 2 refs. Translated from Russian. Associated Technical Services, 4p., Jan. 1950.*

NTIS, DDC: AD-678899

The use of basic zinc stearate for the determination of droplet size in oil fogs is described. Measurement of rim angles was done with a horizontally arranged microscope equipped with an eyepiece grid and a draw tube with a circular scale. Discrepancies between the values of alpha obtained from various lenses did not exceed 1-2 degrees. It was adequate for each oil to take the average of three measurements. The size of the angle is practically independent of the size of the lens, and since the measurements in the case of large lenses are more precise, lenses having diameters of 1-2 mm and objective no. 2 were used. It is evident that even in the case of such large drops the departure from sphericity, apparent from the difference between the calculated and measured values of D/d, is comparatively small.

1948

34672 **APTIC NO. 57581**

Crawford, V. A. and F. C. Tompkins

THE ADSORPTION OF GASES SO2, NH3, CO2 AND N2O ON BAF2 CRYSTALS. *Trans. Faraday Soc., vol. 44:698-708, 1948. 15 refs.*

The adsorption of sulfur dioxide, carbon dioxide, ammonia, nitrous oxide on barium fluoride crystals was measured over the temperature range -78 to 119 C. The values obtained were corrected for adsorption on the glass walls of the apparatus used. The adsorption of the four gases was reversible and complete within 5 min at all temperatures. No correction was necessary for deviations from the perfect gas equation in the pressure range used. Heats of adsorption were calculated from the isotherms using the Clausius-Clapeyron equation and the B.E.T. equation. There was no constant variation in heats of adsorption with temperature, but the variation decreased with increased adsorption for all the gases. The decrease of heats with coverage that was found experimentally was discussed and compared with those expected theoretically. Variation in adsorption potential over the crystal surfaces were calculated in an approximate manner, and the significance of these were discussed from the viewpoint of the applicability of the B.E.T. multilayer theory.

1940

34673 **APTIC NO. 57154**

Lapple, C. E. and C. B. Shepherd

CALCULATION OF PARTICLE TRAJECTORIES. *Ind. Eng. Chem., 32(5):605-617, May 1940. 21 refs.*

Improved operation in spray drying or cooling, centrifugal and gravity collection or separation, spray absorption, and smoke abatement require the calculation of the paths described by component bodies and paths. Theoretical equations were developed for defining two-dimensional particle motion in the presence of a gravitational field, one-dimensional motion in the absence of a gravitational field, and two-dimensional motion in a centrifugal field. The general procedure by which the formulae were derived involved the determination of a velocity-time relation for the motion of the particle in component directions. Once this was obtained, the distance travelled in a component direction was obtained as a function of time by simple graphical integration under a curve in which velocity was plotted against time. Applications of particle calculation to sampling dust-laden gases assumes that the average velocity at the sample intake nozzle is substantially equal to the local velocity of the main stream at the sample point, both in magnitude and direction.

1932

34674 **APTIC NO. 57542**

Bretsznajder, S.

ON CERTAIN IRREGULARITIES IN THE CAO-SO2 SYSTEM AND THE CAO-CO2 SYSTEM. *(O pewnych nieprawidlowosciach w zachowaniu sie ukladow CAO, SO2 i CAO, CO2). Text in Polish. Roczniki Chem., vol. 12:551-566, 1932. 16 refs.*

The equilibria of the above systems were studied both statically and by the flow method. Pure calcium oxide absorbed carbon dioxide and sulfur dioxide even when the gas pressure was considerably lower than the equilibrium pressure of the system. Pressure temperature curves were obtained that were lower than the normal equilibrium curves. The gas was taken up slowly, and approximately 24 hours were required to reach a considerably depressed equilibrium pressure-temperature curve. These phenomena cannot be explained by assuming the existence of solid solutions; it is presumed that the gas is first absorbed on the surface, and subsequently is firmly bound to certain active positions on the surface of the crystal. At excess CO2 pressures, the pressure-temperature curve was at first higher than normal. Immediately after decomposition in a vacuum, the system exhibited a low pressure-temperature curve. These apparent equilibrium curves gradually approached the normal curves. These false equilibria were a concomitant of systems with high surface energies.

1931

34675 **APTIC NO. 57224**

Durau, F.

STUDY OF THE GAS BINDING TO POTASSIUM PERMANGANATE. *(Ueber Gasbindung am Kaliumpermanganat). Text in German. Z. Physik. Chem. Abt. A (Leipzig), 156(3):195-209, 1931.*

To test whether the adsorption of gases shown by sodium chloride occurs with other salts as well, the highly reactive salt, potassium permanganate, was selected. It was pulverized and sifted in sieves with mesh numbers 300 and 4900/sq cm. Of the gases tested, only nitrogen and oxygen showed a true, though weak, adsorption. With hydrogen, carbon monoxide, carbon dioxide, and sulfur dioxide, a chemisorption was observed in addition to adsorption. The results rule out any absorption, particularly as demonstrated with hydrogen measurements. If the amounts of chemisorbed gases are correctly measured, it can be concluded that the adsorbent is not even covered with a monomolecular layer of adsorbed gas. Comparison of the propane adsorption isotherms on NaCl and KMnO4 shows that apart from adsorption by van der Waal forces, adsorption by lattice defects also takes place.

34676 **APTIC NO. 57565**

Foote, H. W. and Joseph Fleischer

EQUILIBRIUM IN SYSTEMS COMPOSED OF SULFUR DIOXIDE AND AMMONIUM OR AN ALKALI IODIDE. *J. Am. Chem. Soc., 53(5):1752-1763, May-Aug. 1931. 7 refs.*

The composition of the solid phases and the vapor pressure relations in the two component systems consisting of sulfur dioxide with sodium, potassium, rubidium, cesium, and ammonium iodides within the temperature range of -25 to 25 deg was studied. The invariant points within this temperature range were also determined. A slow reaction takes place between the components at room temperature which results in the liberation of iodine. The NaI, KI, RuI, and NH4I-SO2 systems each formed three invariant systems with constant vapor pressure exhibited on either side of the pure compound regardless of the relative amounts of the phases present, while the CsI-SO2 system exhibited two. Curves for vapor pressure versus temperature for all systems are supplied.

1930

34677 **APTIC NO. 57228**

Herbert, J. B. M.

THE SORPTION OF GASES ON CRYSTAL SURFACES. *Trans. Faraday Soc., vol. 26:118-137, 1930. 6 refs.*

The rates of sorption on sodium chloride were studied for ammonia at 177 to 588 mm mercury and for sulfur dioxide at 61 to 561 mm. Ammonia sorption on sapphire between 8 and 718 mm at OC were also investigated. The results of the experiments for NaCl show that the complete isotherm for any pressure within the range studied is S-shaped. Different portions of the complete curve are covered by observations at different pressures. A sufficiently close approach to saturation to enable extrapolation to be made to the equilibrium value could not be obtained, even in long-term experiments.

1929

34678 **APTIC NO. 57186**

Manchot, W. and H. Schmid

ON THE REACTION OF SULFUR DIOXIDE WITH NITROGEN DIOXIDE. *(Ueber die Reaktion von Schwefeldioxyd mit Stickstoffdioxyd). Text in German. Chem. Ber., vol. 62:1261-1263, 1929. 2 refs.*

The products of the reactions of sulfur dioxide and sulfur trioxide with nitrogen dioxide were chemically analyzed. Because of their hygroscopy and their adherence to glass surfaces, a special glass reaction apparatus had to be built. The gases were heated in a glass tube and the reaction product was condensed in a small glass tube. Nitrogen was determined with heated copper and an azetometer, and sulfur was determined as sulfate with hydrogen superoxide. The product, formerly assumed to be (SO3)2.NO, was identified as 2SN209. It can also be obtained from the reaction of SO2 with nitrous anhydride. Experiments with liquid reactants at -10 C also yielded S2N209. Prolonged heating favored the formation of the polymer S4N2015. The fact that dry SO2 and NO2 are able to react is significant for the theory of the lead chamber process.

1925

34679 **APTIC NO. 57571**

Patrick, W. A. and C. E. Greider

HEATS OF ADSORPTION OF SULFUR DIOXIDE AND OF WATER VAPOR BY SILICA GEL AT O C. *J. Phys. Chem., vol. 29:1031-1039, 1925. 9 refs.*

The saturation values for the net heat of adsorption of sulfur dioxide and water vapor by silica gel were very nearly coincidental the SO2 exceeding the water vapor by less than one calorie. Explanations based on surface energy considerations were presented in both cases to account for the difference between the heat of adsorption and the heat of liquefaction. The possible causes of the difference between the net heats of adsorption of SO2 and of water vapor were discussed. One explanation of the slightly greater heat of adsorption at saturation in the case of sulfur dioxide is the formation of one of the various hydrates of sulfur dioxide by means of the water already present in the silica gel. A diagram of the apparatus used for the experiment, and graphs illustrating the different aspects of the process are also included.

1923

34680 **APTIC NO. 57595**

Evans, M. H. and H. J. George

NOTE ON THE ADSORPTION OF GASES BY SOLIDS AND THE THICKNESS OF THE ADSORBED LAYER. *Proc. Royal Soc. (London) Ser. A., vol. 103:190-193, 1923.*

The number of molecules of carbon dioxide required to give a monomolecular layer on the adsorbing surface of glass fibers was calculated assuming the adsorbed gas to exist as a film with the density of the liquid. This experiment was based on a proposal by Mulfarth concerning the relative adsorption of acetylene, nitrous oxide, carbon dioxide, ammonia, and sulfur dioxide by powdered glass. Results with other gases were in sufficient agreement to prove clearly that in the case of these gases, the force of molecular attraction exerted by the glass surface extends to distances considerably greater than the diameter of a molecule.

1922

34681 **APTIC NO. 57167**

Burdick, Charles Lalor

THE OXIDATION OF NITRIC OXIDE AND ITS CATALYSIS. *J. Am. Chem. Soc., vol. 44:244-251, Jan.-June 1922.*

A study of the oxidation of nitric oxide in the presence of various contact catalysts has shown that ordinary impregnated or unimpregnated materials posses no specific catalytic action. Highly absorptive forms of carbon or charcoal may increase the reaction as much as 500-fold. The presence of water vapor in the gas mixtures greatly reduces the catalytic activity of charcoal, but an increase in temperature to above the point of condensation of the aqueous vapor counteracts this effect to some extent. The temperature coefficients for both the catalyzed and uncatalyzed reactions are in general negative, but the temperature coefficient for the catalyzed reaction in the presence of H2O is positive. The positive temperature coefficient is probably due to the decreased absorption of H2O by the catalyzer at elevated temperatures.

1920

34682 **APTIC NO. 57220**

Ephraim, Fritz

ON THE ADDITION PRODUCTS OF SULFUR DIOXIDE WITH ALKALI IODIDES (ALKALI IODIDE SULFONES). *Ueber Additionsprodukte von Schwefeldioxyd an Alkalijodide (Alkalijodid-sulfone)). Text in German. Chem. Ber., 1(53):118, 1920. 3 refs.*

Investigations of alkali iodide sulfones were published without reference to the work of Kornblum and Ephraim. In the referenced paper the formula MeI.3SO2 was used uniformly, while Ephraim found a number of different addition products, often simultaneously present distinguished by their characteristic colors. This explains the substantial difference in the results reported.

34683 **APTIC NO. 57196**

McGavack, John, Jr. and W. A. Patrick

THE ADSORPTION OF SULFUR DIOXIDE BY THE GEL OF SILICIC ACID. *J. Am. Chem. Soc., vol. 42:946-978, 1920. 21 refs.*

The adsorption of sulfur dioxide by silica gel was measured at various temperatures between -80 and 100 C. The effect of water content of the silica gel was studied. Maximum adsorption was shown by gels containing about 7% water. The adsorption was reversible in the absence of air. In the presence of small amounts of air, the rate of adsorption was greatly decreased and adsorption and desorption were irreversible. The volume occupied by the adsorbed vapor was the same at the same value of the corresponding pressure of the gas phase divided by the vapor pressure of the liquid. An equation expressing this relationship was given. The equation of Freundlich held over almost the entire range studied, exceptions being noted at the points where the saturation pressures were approached.

34684 **APTIC NO. 57192**

Miller, E. B.

ADSORPTION BY SILICA GEL. I. *Chem. Met. Eng., 23(24):1155-1158, Dec. 1920.*

The adsorption of a number of vapors by silica gel has been studied at different temperatures. Vapors of liquids with a high boiling point were more strongly adsorbed than vapors from a liquid with a low boiling point. Adsorption decreased with increasing temperatures. Also, the greater the partial pressure of the vapor being adsorbed, the greater was the extent of the adsorption. Data on the adsorption of the sulfur dioxide are given. Temperatures of 0 to 20 C gave the best adsorption rate. A practical rate of flow of SO2 for best adsorption is 50 cc/min/g of gel, which is approximately 0.8 cu ft/min/pound of gel. This allows about 0.6 sec for contact. With respect to the recovery of the adsorbed material, silica gel has a marked advantage over other adsorbents. Little sulfur dioxide is adsorbed at 100 C. The SO2 may be recovered by heating the adsorbent to 100 C or above at which point it is liberated.

1916

34685 **APTIC NO. 57256**

Ephraim, Fritz and Isaac Kornblum

ON THE NATURE OF THE SECONDARY VALENCES. XIII. COMPLEXES WITH SULFUR DIOXIDE. *(Ueber die Natur der Nebenvalenzen. XIII: Komplexe mit Schwefeldioxyd). Text in German. Chem. Ber., 2(49):2007-2021, 1916. 11 refs.*

The absorption process and the absorption products of sulfur dioxide by iodides, rhodanides, and aluminum halogenides were investigated. Usually complexes are formed whose structural formulas are derived from chemical analysis, the partial vapor pressures, and the color formation. Sulfur dioxide is added to both the anionic and cationic parts of the complex. One mole LiI with two moles SO2 at zero C yields a complex with the color of bichromate. A red complex is obtained with NaI. It decomposes quickly and has the structure NaI.4SO2. Other iodides investigated were potassium, rubidium, cesium, barium, strontium, and calcium iodides. All these complexes are more or less red and decompose easily. In contrast, the rhodanides are stable below their temperature of formation and are yellow. Potassium thiocyanate formed KCNS.SO2. Rubidium thiocyanate, CsCNS, and calcium rhodanide were also investigated. Sodium, ammonium, barium, and strontium rhodanide do not abosrb SO2. Also investigated was the absorption of SO2 by aluminum chloride, bromide, and iodide. The following substances do not absorb SO2: ferrichloride, chromichloride, silver iodide, thalloiodide, tin iodide, cadmium iodide, and the chlorides and bromides of potassium and sodium. The vapor pressures of all the substances at various temperatures are reported.

EFFECTS-HUMAN HEALTH

1974

34686 **APTIC NO. 56984**

Anderson, Ib, Gunnar R. Lundqvist, Preben L. Jensen, and Donald F. Proctor

HUMAN RESPONSE TO CONTROLLED LEVELS OF SULFUR DIOXIDE. *Arch. Environ. Health, 28(1):31-39, Jan. 1974. 26 refs.*

Nasal mucus flow rate, airway resistance, and subjective response were studied in 15 young men during 6-hour exposures to 1, 5, and 25 ppm sulfur dioxide. A significant decrease in nasal mucus flow rate during 5 and 25 ppm exposures were observed. This decrease was greatest in the anterior nose and in subjects with an initially slow mucus flow rate. Pharyngeal air samples yielded less than 1% of the SO2 inhaled, even after a 6-hour exposure to 25 ppm SO2. Increased nasal airflow resistance and a fall in forced expiratory volume in 1 sec and forced expiratory flow during the middle half of expire volume occurred at all exposure levels, but there was no change in closing volume. Discomfort was proportional to SO2 concentration, but never excessive. Subjects with initially slow nasal mucus flow rates experienced the greatest discomfort. The acute effects of SO2 exposure appear to justify reduction of the present threshold limit value of 5 ppm to 1 ppm, and provide support for a nasobronchial reflex bronchoconstriction. (Author abstract)

34687 **APTIC NO. 57724**

Kaul, Balkrishena, John Calabro, and Duncan E. Hutcheon

EFFECTS OF CARBON MONOXIDE ON THE VULNERABILITY OF THE VENTRICLES TO DRUG-INDUCED ARRHYTHMIAS. *J. Clin. Pharmacol., 14(1):25-31, Jan. 1974. 18 refs.*

Dogs under pentobarbital anesthesia were resistant to direct electrocardiographic changes during carbon monoxide inhalations. Exposure to 0.5% carbon monoxide raised carboxyhemoglobin concentrations approximately 20% and produced evidence of enhanced sensitivity to digitalis-induced ventricular tachycardia. However, no increase in the vulnerability of the ventricles to hydrocarbon/epinephrine or to digitalis-induced fibrillation was observed following exposure to carbon monoxide which provided blood levels of 35% carboxyhemoglobin. (Author summary)

34688 **APTIC NO. 56978**

Theriault, Gilles P., John M. Peters, and William M. Johnson

PULMONARY FUNCTION AND ROENTGENOGRAPHIC CHANGES IN GRANITE DUST EXPOSURE. *Arch. Environ. Health, 28(1):23-27, Jan. 1974. 23 refs.*

Chest roentgenograms (x-rays) of 784 granite shed workers were classified according to UICC/Cincinnati classification, and their relationships to lifetime dust exposure, ventilatory function, and smoking habits were studied statistically. Increase in dust exposure correlated with increase in size of rounded opacities and profusion. Workers with abnormal x-rays were exposed on the average to 2.3 times more dust than those with normal ones. Irregular opacities were related more to smoking than to dust. Forced vital capacity was lower for people with abnormal x-rays and decreased with greater profusion. Residual volume increased with smoking but not with dust exposure. No trend was shown for total lung capacity. A dose-response curve of dust on ventilatory function and on x-rays showed that the effects on ventilatory capacity took place 13.5 years before opacities on x-rays. (Author abstract modified)

1973

34689 **APTIC NO. 57693**

Bentsko, V.

HYGIENIC PROBLEMS OF AIR POLLUTION DUE TO ARSENIC. *(Gigiyenicheskiye voprosy zagryazneniya vozdukha mysh yakom). Text in Russian. Gigiena i Sanit., no. 10:85-87, 1973. 10 refs.*

The cumulation and the effects of ingested and inhaled arsenic were studied on rabbits and bats. Inhalation tests on rabbits, and oral poisoning tests performed on bats revealed decrease in the As levels in muscles, liver, and lungs by the 12th mo following an initial increase. The As levels were highest in the kidneys, hair, and claws. No As was detected in the inner organs of newborn rabbits. Bats exposed to an aerosol containing 1% of the As showed a steady increase in the As levels in the inner organs during the first two weeks, after which a rapid decrease in the hepatic As content was observed. Hepatomegalia, reduction of the spleen weight, and statistically significant decreases in the metabolic respiration of the hepatic parenchyma were observed in bats fed 50 and 250 mg/l of As. The maximum no-effect dose of As was 5 mg/l. Investigations of the As contents in the hairs of children living in an area around a thermal power plant emitting As revealed good agreement between the findings and the theoretically expected dispersion of the flue gases.

34690 **APTIC NO. 56983**

Castleman, W. L., D. L. Dungworth, and W. S. Tyler

HISTOCHEMICALLY DETECTED ENZYMATIC ALTERATIONS IN RAT LUNG EXPOSED TO OZONE. *Exp. Mol. Pathol., 19(3):402-421, 1973. 28 refs.*

Enzymatic activities were studied histochemically in lungs from young rats which were exposed to 0.8 ppm ozone continuously for 7 days. Walls of terminal airways and interalveolar septa in centriacinar regions were the areas of the lung most noticeably affected by O3 exposure. Histologically these structures were thickened and infiltrated by mononuclear cells. Bronchiolar epithelium in infiltrated areas had lower NADH and NADPH-diaphorase reactivities and higher ATPase reactivity than similar epithelium in control lungs. Intralveolar septa in centriacinar regions of O3-exposed lungs had increased diaphorase, LDH, ATPase, and cytochrome oxidase reactivities. Increased septal histochemical reactivity was observed not only in the centriacinar zone of septa that were thickened and infiltrated, but also in an immediately adjacent zone of septa that were histologically unaffected. The increases in enzymatic reactivity could be part of a protective mechanism operating locally in centriacinar regions of O3-exposed lungs to help maintain cellular integrity. (Author abstract)

34691 **APTIC NO. 57122**

Charpin, J.

AIR POLLUTION AND BRONCHOPULMONARY PATHOLOGY. *(Pollution atmospherique et pathologie broncho-pulmonaire). Text in French. J. Eur. Toxicol., no. 2:65-69, March-April 1973. 24 refs.*

Epidemiologic studies concerning the relationship between bronchopulmonary pathology and air pollution, especially due to sulfur dioxide, carbon monoxide, and nitrogen oxides, are reviewed. Changes in the dynamic resistance of the respiratory tract, mucous hypersecretion, and modification of the acetylcholine test due to inhalation of SO2 were observed in guinea pigs. The ever-increasing morbidity figures regarding chronic bronchitis and asthma, especially in urban dwellers, strongly suggest relationships between bronchopulmonary pathology and air pollution. Relation between the measured daily pollution levels and mortality was established in New York City. Similar relationships between the number of daily admissions into hospitals due to asthma and the pollution level in New Orleans was determined. Chronic bronchitis is strongly influenced by air pollution both in its genesis and its evolution, while asthma may be facilitated in its genesis by the specific sensitivity of the mucosa to non-specific pollutants. Epidemiological surveys indicate increases in the occurrence of bronchopulmonary cancer in urban and industrial areas, and the possible role of benzo(a)pyrene and asbestos in this increase.

34692 **APTIC NO. 57732**

Cross, Carroll E.

LUNG OXIDANT TOXICITY. *Calif. Med., 119(5):48, Nov. 1973. 4 refs.*

Pulmonary oxidant toxicity is discussed, including studies describing lung damage, the time-dose relationship and susceptibility, effect of oxidants on cells and lipid oxidation, effects on enzymatic thiol groups, effects on lipid peroxidation, and lung antioxidant defense mechanisms.

34693 **APTIC NO. 56982**

Davis, J. M. G. and S. W. Coiam

EXPERIMENTAL STUDIES ON THE EFFECTS OF HEATED CHRYSOTILE ASBESTOS AND AUTOMOBILE BRAKE LINING DUST INJECTED INTO THE BODY CAVITIES OF MICE. *Exp. Mol. Pathol., 19(3):339-353, 1973. 30 refs.*

Mice were injected intrapleurally with chrysotile asbestos dust heated to varying temperatures up to 1000 C. The physical shape of the dust particles was more important than the altered chemistry of the dust. Chrysotile heated to no more than 400 C produced dust samples containing many long fibers, and these samples resulted in large pleural granulomas. Chrysotile heated to more than 400 C produced dust containing mainly particles of low aspect ratio, and these produced very small granulomas. The initial size of the granulomas was very closely related to the final degree of fibrosis found in the animals and, therefore, chrysotile heated to 400 C or less was much more fibrogenic than when it was heated to higher temperatures. A sample of automobile brake lining dust contained very little recognizable chrysotile, and consisted mainly of particles with a low aspect ratio. When this dust was injected into the pleural cavities of mice, it produced very small granulomas and little fibrosis. (Author abstract modified)

34694 **APTIC NO. 56979**

Elia, Victor J., Lalitha Murthy, and Harold G. Petering

ISOLATION OF METAL-BINDING AGENTS FROM COAL DUST AND THEIR EFFECTS ON MITOCHONDRIAL FUNCTION. *Environ. Letters, 5(4):237-248, 1973. 10 refs.*

Bituminous coal samples were extracted with a series of organic solvents. The extracted materials, amounting to 58-70 mg/g of Utah coal and 12-15 mg/g of Pennsylvania coal, were fractionated on a carboxymethyl cellulose column in the Cu(II) form. The copper-binding fractions for Utah and Pennsylvania were 30% and 22%, respectively, of the total extract. Copper-binding capacity was 400 micrograms copper/g and 40 micrograms/g, respectively. The copper-binding ligands from both coals uncoupled oxidative phosphorylation of isolated rat liver mitochondria, a system containing copper and iron metalloenzymes. The inhibitory activity was higher for Pennsylvania than Utah coal, suggesting that the extraction and absorption of metal-binding agents from coal may adversely alter vital cellular energetics. Thus, metal-binding ligands may interfere with trace metal metabolism by interacting with essential trace metals. (Author abstract modified)

34695 **APTIC NO. 57388**

Friedrichs, Karl Heinz and Friedrich Pott

FIBROUS DUSTS IN THE AIR AND THEIR HYGIENIC SIGNIFICANCE. *(Faserfoermige Staeube in der Aussenluft und ihre gesundheitliche Bedeutung). Text in German. Proc. Int. Clean Air Congr., 3rd, Duesseldorf, West Germany, 1973, p. A7-A10. 12 refs.*

Concentrations of fibrous dusts in the indoor and outdoor air were measured, and the carcinogenic effects of fibrous and non-fibrous dusts of different chemical composition were studied in male rats. The fibrous dust concentrations measured inside a fully climatized office building ranged from 30 to 4740 fibers per cu m. The outdoor concentrations of fibrous dusts measured near an asbestos plant were in a range of 1220-6780 fibers per cu m. Tests performed on male rats that were given i.p. injections of fibrous and non-fibrous dusts of actinolite, biotite, chrysotile, gypsum, glass fibers, haematite, nemalite, pectolite, sanidin, and talc in a fraction below 5 micron for occasions at 7 days intervals revealed largely equal carcinogenic effects of chrysotile, nemalite, and glass fibers. Non-fibrous dusts of actinolite, biotite, and talc produced no tumors within 530 days. It is concluded that the carcinogenic property of asbestos is determined by its fibrous character rather than by its chemical composition.

34696 **APTIC NO. 56996**

Frost, John K., Prabodh K. Gupta, Yener S. Erozan, Darryl Carter, David H. Hollander, Morton L. Levin, and Wilmot C. Ball, Jr.

PULMONARY CYTOLOGIC ALTERATIONS IN TOXIC ENVIRONMENTAL INHALATION. *Hum. Pathol., 4(4):521-536, Dec. 1973. 54 refs. (Presented at the American Society of Clinical Pathologists, Symposium on Environment Year of Pathology, Oct. 1972.)*

Toxic elements of the environment adversely affect tissues, structures, and functions of the respiratory system. Many of these changes are reflected in cells and other elements of pulmonary secretions. Natural defense mechanisms of the respiratory tract are impaired, rendered less effective, and eventually invalidated by toxic inhalants. The effects of pollution on the mucus, respiratory macrophage, ciliated cell, respiratory epithelium, and the process of metaplasia are discussed. Tissues changes in response to pollutants, especially of the epithelium, can be studied and evaluated cytologically with detection and identification of the various degrees of atypia. These cytologic alterations appear to be valid indications of the carcinogenic potentialities of environmental toxins. In three occupational groups, increased frequency of these changes appear to parallel the presence of known or suspected carcinogenic pollutants. These groups were utility company workers (low risk environment), abestos workers, and chemical industry workers. The cytologic identifications may help indicate individuals or groups for whom preventive or other measures are most needed. (Author abstract modified)

34697 **APTIC NO. 56977**

Hammer, D. I., A. V. Calocci, Victor Hasselblad, Marcia E. Williams, and Cecil Pinkerson

CADMIUM AND LEAD IN AUTOPSY TISSUES. *J Occup. Med., 15(12): 956-962, Dec. 1973. 23 refs. (Presented at the American Medical Association, Annual Convention, 122nd, New York, June 23-27, 1973.)*

Age, sex, race, smoking habits, and pathologic diagnoses were obtained for 120 sets of autopsy tissue which were analyzed for trace metals by atomic absorption spectrophotometry. Bone, kidney, and liver lead levels were higher in adults and blacks. Renal cadmium levels were higher in males, whites, and cigarette smokers and increased to middle age. Cancer patients had higher and more variable renal cadmium levels than noncancer patients. Cadmium and zinc increased on an equimolar basis in the kidney. Estimated cadmium body burdens in adult, male, and cigarette smokers were more than twice those of comparable nonsmokers. Studies characterizing body metal burdens or relating specific metals to diseases will be hopelessly confounded unless they note pertinent covariates such as age, sex, race, cigarette smoking, and diagnoses at death. (Author abstract modified)

34698 **APTIC NO. 57168**

Horcicko, J., J. Borovansky, and J. Duchon

DISTRIBUTION OF ZINC AND COPPER IN HUMAN HEAD AIR OF DIFFERENT COLORS. *(Verteilung von Zink und Kupfer im menschlichen Kopfhaar vereschiedener Farbtoene). Derm. Monatsschr., 159(3):206-209, 1973. 21 refs. Translated from German, 7p.*

The amount of zinc and copper in human hair of various shades and in isolated hair melanosomes was investigated. The Zn content increases as the shade of the hair darkens. Isolated melanosomes contained 4 1/2 times more Zn and 3 times more Cu than the whole hair samples. (Author summary modified)

34699 **APTIC NO. 57745**

Horning, E. C., M. G. Horning, D. I. Carroll, R. N. Stillwell, and I. Dzidic

NICOTINE IN SMOKERS, NON-SMOKERS AND ROOM AIR. *Life Sci., 13(10):1331-1346, 1973. 5 refs.*

Nicotine is commonly observed in smokers urine, and this circumstance was used to develop atmospheric pressure ionization mass spectrometric techniques for the detection of volatile components of urine which behave as bases in the gas phase. When these methods were applied in an examination of urinary bases of nonsmokers who shared the laboratory area with smokers, nicotine was present to the extent of about 5% of that observed for smokers. Two routes of nicotine transfer seemed possible: water and air. The water supply was nicotine-free. An air analysis method was devised using the atmospheric pressure ionization mass spectrometer. This showed that nicotine was present in the laboratory air, so the probable route of transfer for nonsmokers was through room air. (Author abstract modified)

34700 **APTIC NO. 56959**

Kimura, I., H. Shioi, T. Suda, Y. Kawarada, Y. Sato, N. Konno, S. Sakurai, and H. Tsunoda

EXPERIMENTAL EXPOSURE OF GOATS TO ENVIRONMENTAL POLLUTION BY FLUORIDES IN THE AIR, PART II: RESULTS OF CLINICAL EXAMINATIONS FOR ONE YEAR. *(Taiki chu fukkabutsu no kankyo osen ni yoru yagi no bakuro jikken -dai 2ho- ichinenkan no rinsho kensa seiseki). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):419, Oct. 1973. (Presented at the Japan. Society for Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973.)*

A comparison of the rate of weight increase and blood chemistry in goats bred in fluorine-polluted and control areas is given. No difference of the rate of body weight increase, nor any difference in tissue appearance or palpitation is noted. Hematocrit percentage, hemoglobin, total protein, albumin, glucose, bilirubin, TTT, ZTT, GOT, GTP, Alkaline-phosphatase, LDH, LAP, cholesterol, BUN, nutrition, liver function, and enzyme activity were similar for the experimental and control goats for the first year.

34701 **APTIC NO. 57314**

Knelson, John H., Frederick Coulston, Leon Golberg, Travis Griffin, and James Bradely

THE ROLE OF CLINICAL RESEARCH IN ESTABLISHING STANDARDS FOR ATMOSPHERIC LEAD. *Staub, Reinhaltung Luft, 33(11):446-448, Nov. 1973. 8 refs. (Presented at the VDI-Colloquium on Heavy Metals as Air Pollutants, Duesseldorf, Feb. 22-23, 1973.)*

Exposure experiments conducted at the Clinton Correction Facility, Dannemora, New York, are used as an example of how clinical environmental research can be conducted, and the results are interpreted for the purpose of defining environmental hazards. After baseline metabolic studies and determination of blood lead concentrations, controlled exposure began. Atmospheric lead aerosol was generated by burning tetraethyl lead in a propane flame and by introducing the resulting lead oxide particulates into the separate air conditioning system for the exposure room. Over 80% of the particles generated had a mass median equivalent diameter of 0.18 micron or less. The men remained in the large room with controlled atmospheric environment approximately 23 hr/day, 7 days a week for the exposure period. A mean air lead of 10.9 micrograms/cu m was achieved for the first exposure which lasted as long as 20 weeks. The second exposure was conducted in the same manner with an average air lead concentration of 3.2 micrograms/cu m. A control group lived under very similar circumstances except that they breathed ambient air containing less than 0.2 micrograms/cu m of lead. Exposure to air lead concentrations as low as 3.2 micrograms/cu m was found associated with a significant increase in blood lead concentration. The five men who had been previously exposed entered the second exposure with blood lead concentrations significantly higher than the eight men who had not been previously exposed. These five men continued to have higher blood levels which gave rise to the speculation that the previous exposure in some way altered the response to the second exposure.

34702 **APTIC NO. 57517**

Knelson, John H.

CARBON MONOXIDE AND CARDIAC HEALTH. *Preprint, American Public Health Assoc., 12p., 1973. 21 refs. (Presented at the American Public Health Association, Annual Meeting, 101st, San Francisco, Calif., Nov. 4-8, 1973.)*

The toxic effect of carbon monoxide on the cardiac system is discussed with respect to relative risk factors, the exposure/effect matrix, the range of susceptibility, and methods of diagnosing susceptibility. Coronary heart disease is a major problem due to CO in tobacco smoke and air pollution. Coronary heart disease is the greatest single killer. Recent research indicates the probable importance of CO in coronary heart disease. A mosaic of information, not all of it consistent, is emerging from epidemiological, animal, and clinical studies. Several studies are discussed which correlated CO effects with exercise and cardiac health.

34703 **APTIC NO. 57530**

Knelson, John H.

PROBLEM OF ESTIMATING RESPIRATORY LEAD DOSE IN CHILDREN. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., Human Studies Lab., 15p., Nov. 1, 1973. 15 refs.*

Children may be exposed to lead in the environment by a variety of ways, primarily by ingestion or inhalation. The serious public health problem of overt lead intoxication from eating lead-based paint has tended to obscure low level toxicity which may be related to atmospheric lead pollution. No data exist which relate potential body burden or blood lead levels in children to ambient air lead levels. Extrapolation from respiratory lead uptake kinetics in adults is complicated by the differences in respiratory physiology, metabolism, and body compartment sizes existing between children and adults. These differences and models from pediatric pharmacology were used to approach the problem of predicting respiratory lead dose in children from data based on adult uptake studies. Because children have higher metabolic and ventilation rates than adults and greater activity levels, children would receive a disproportionately larger respiratory dose compared to either their mass or surface area. (Author abstract modified)

34704 **APTIC NO. 56985**

Kosmider, Stanislaw, Edmund Rogala, Zbigniew Szulik, and Jerzy Dwornicki

INFLUENCE OF TRACE METALS ON DISORDERS OF ACID-BASE BALANCE AND MINERAL METABOLISM IN SUBACUTE POISONING BY HYDROGEN SULFIDE. *(Wplyw metali sladowych na zaburzenia rownowagi kwasowo-zasadowej i gospodarki mineralnej w podostrym zatruciu siarkowoderem). Text in Polish. Patol. Polska (Warsaw), 24(1):171-186, 1973. 12 refs.*

Electrolyte disorders and acid-base balance were studied experimentally in animals poisoned with hydrogen sulfide. The effect of HS2 on kidney metabolism and its mechanism were also studied. Subacute H2S exposure caused disorders of minerals and acid-base balance in blood. The mechanism of the toxic action of H2S consisted of the formation of compounds with alkali metals to produce sulfides, abolishing the action of the metals as activators of a number of enzymes, as demonstrated in vitro. Poisoning with HS2 produced disorders in the metabolism of the kidneys. Vitaral administered during the poisoning improved the mineral disorders, acid-base balance, and activity of enzymes blocked by H2S in the kidneys. Vitaral should be used in the prevention and therapy of HS2 poisoning.

34705 **APTIC NO. 57117**

Kosmider, Stanislaw, Mieczyslaw Luciak, Kazimierz Zajusz, Adam Misiewicz, and Jan Szygula

STUDIES ON EMPHYSOGENIC ACTION OF NITROGEN OXIDES. *(Badania nad rozedmotworczym dzialaniem tlenkow azotu). Text in Polish. Patol. Polska (Warsaw), 24(1):107-125, 1973. 20 refs.*

Guinea pigs were chronically exposed to nitrogen oxides; one group was exposed to 1 ppm for 6 mo and another group was exposed to the reaction products of binding NOx in 1 ppm concentration by gaseous ammonia. Lesions formed in the respiratory system. Immunity was diminished. Higher incidence of infectious in body weight, disorders of acid-base balance, and results of urinalysis were recorded. The urinary excretion of hydroxyproline and acid mucopolysaccharides was assayed. The lungs were examined histologically and histoenzymatically. Nitrogen oxides inhibited protein synthesis, causing a drop in total serum proteins and immune globulin levels and inhibiting body weight gain. These disorders caused diminished immunity and higher incidence of infections. Diminished activity of pulmonary enzymes taking part in electrolyte transport and active transport in the exposed animals was probably a cause of the observed metabolic disorders. Prolonged exposure to low concentrations of NOx damages the respiratory tract, causing bronchospasm and bronchitis; reduced gas exchange is the cause of disorders in acid-base balance. Emphysema observed after prolonged exposure to NOx is caused by damage of collagen, shown by increased urinary excretion of its degradation products, and by other factors. Neutralization of NOx by gaseous NH3 prevented the disorders to a marked degree.

34706 **APTIC NO. 57312**

Kunitake, Eisaburo, Koichi Nobutomo, Yasushi Kodama, and Noburu Ishinishi

STUDIES ON THE PREVALENCE OF THE CHRONIC OBSTRUCTIVE LUNG DISEASE AMONG THE RESIDENTS IN KITAKYUSHU CITY. *(Kitakyushu-shi ni okeru mansei kokvuki shikkan yushoritsu ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):478, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 210.)*

The respiratory system disease morbidity of Kitakyushu city residents was investigated and polluted and unpolluted areas were compared. Areas with an average sulfur trioxide measurement of more than 1.5 mg/100 sq cm/day were designated as polluted, and those with 0.5-0.8 mg/100 sq cm/day were designated as unpolluted. Residents from 11 polluted and four unpolluted districts who have lived in the area for more than 3 years and who are above 40 years of age were given the questionnaire, a chest x-ray, and a general physical examination. The return rates for the questionnaire in the polluted and unpolluted areas were both 95%. The morbidity for men and with a second-degree cough was 8.7%, second degree sputum, 21.7%, and chronic bronchitis 7% in the polluted area, and 8.4%, 12%, and 2.4% respectively for the unpolluted area. The rates were similar but generally slightly lower in all categories for women. The morbidities of chronic bronchitis among smoking men and smoking women were taken separately but found both 12.3% in the polluted area, for former smokers, 19%, and for nonsmokers, 2.8%. For non-smoking men 3.7% and zero for former smokers and non-smoking men in the unpolluted area. For smoking women, chronic bronchitis morbidity was 12.3%, and 1.3% for non-smoking women in the unpolluted area. Respiratory system disease morbidity in Kitakyushu is not especially high compared to other polluted cities of Japan; being lower than that of Omuta and Kawasaki, and similar to that of Fuji city.

34707 **APTIC NO. 57313**

Kurihara, T., N. Kurihara, T. Watanabe, T. Hata, R. Yoshida, T. Motomiya, M. Adachi, and A. Kosaku

EPIDEMIOLOGICAL STUDY OF ASTHMA AMONG SCHOOLCHILDREN IN FUNABASHI CITY. *(Funabashi-shi gakudo no kikanshi zensoku chosa). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):471, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 203.)*

The total of 4792 schoolchildren from polluted and unpolluted areas of Funabashi were given a questionnaire, and the parents were given an interview. In 1970, the ratio of asthmatic symptoms were noted in 2.4% of the children in the control group (nonpolluted area) and 4.2% in the children from polluted areas. In the second year of investigation, there was an increase of 96 children who were diagnosed as asthmatic, giving a total of 182 asthmatic children. The total ratio including polluted and unpolluted area was 1.7% in 1970 and 3.2% in 1971. There was no significant difference between two groups. The ratio of asthmatic children in the first grade was 2.6% in 1970 and 4.3% in the second year. Allergen tests were given by the scratch method to 184 children, on house dusts, ragweed, penicillium, arternaria and canjita. The total of any positive reaction ration was 76%; 29% reacted positively to ragweed and 71% to house dusts. The astmatic morbidity of the children from seven grade schools in Funabashi was approximately 3%, and this morbidity was extremely high compared to 1% reported by the Chiba prefectural government investigation of asthmatic children.

34708 **APTIC NO. 57711**

Martyniuk, V. Z. and I. I. Datsenko

ROLE OF OXYCARBON INTOXICATION IN THE DEVELOPMENT OF CARDIO- VASCULAP AND NERVOUS DISEASES. *(Pol oksiuglerodnoy intoksikatsii v razvitii serdechno sosudistykh i nervnykh za olevaniy). Text in Russian. Urachebnoe Delo, vol. 10:134-138, 1973.*

The chronic action of carbon monoxide was studied on animals. The influence of CO on the cardiovascular and nervous systems produced functional disorders of these organs and effected their structure. Significant accumulation of fatty substances, reduction of the glycogen content, and irregular distribution of DNA and RNA during intoxication were evidence of long-standing metabolic disorders in the vital organs of the organism.

34709 **APTIC NO. 57733**

McIntire, Matilda S. and Carol R. Angle

INCREASED RED CELL LEAD IN G-6-PD-DEFICIENT URBAN BLACK SCHOOLCHILDREN. *Paediatrician, 2(1-2):70-82, 1973. 42 refs.*

Forty-four black children at two elementary schools within 0.7 miles of a battery plant had significantly higher blood lead levels (34.2 + or 9.7 micrograms%, mean and standard deviation) than 122 students (26.2 + or 7.1) living at a distance of 0.7-4 miles. Comparable differences were found in red cell lead content 5 mo later (54.8 + or 18.6 verses 36.5 + or - 12.2) although composite air lead monitored at a site 0.7 downwind from the plant was not increased above urban levels. Independent of the effect of location, glucose-6-phosphate-dehydrogenase (G-6-PD) deficient children had higher blood lead levels, after standardization to a hematocrit of 38% (32.9 + or 9.7), than the nondeficient (25.7 + or 8.8), and higher red cell lead levels (47.3 + or - 14.7 versus 35.6 + or 15.8). The increased red cell lead of hypochromia was independent of geographic exposure or enzyme deficiency. (Author abstract)

34710 **APTIC NO. 56957**

Mizoguchi, I., M. Osawa, Y. Sato, K. Makino, and H. Yagyu

STUDIES ON ERYTHROCYTE AND PHOTOCHEMICAL SMOG, PART I: EFFECTS OF AIR POLLUTANTS ON ERYTHROCYTE RESISTANCE. *(Kokagaku sumoggu to sekkekkyu ni kansuru kenkyu- dai 1po, sekkekkyu teiko ni oyobosu osen busshitsu no eikyo). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):414, Oct. 1973. (Presented at the Japan. Society for Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973.)*

Mice were exposed to 1 ppm of ozone, 800 ppm toluene vapor, and 250 ppm ethyl nitrite for 30 min and blood was collected from the heart directly after exposure. Twenty microliter of the blood and 3 ml of 0.02 saline were centrifuged and the supernants were spectrophotometrically determined on the basis of 0% of hemolysis of physiological saline, and 100% of hemolysis of the supernant obtained by distilled water. The resistance of erythrocytes to hemolysis was increased by exposure to 1 ppm of ozone for 30 min, but was not affected by exposure to toluene or ethyl nitrite at concentrations 4-5 times the maximum allowable level. This phenomenon was due to the secondary physiological response to ozone, such as the increase of ATP by activated glycolysis due to the increase of glucose uptake by the erythrocyte which was stimulated by the ozone, and the increase of erythrocyte membrane stability by the activity of the hexose monophosphate shunt.

34711 APTIC NO. 57701

Nishimura, H.

TETATOGENIC SUBSTANCES. *Intern. Chem. Eng., 13(4):774-780, Oct. 1973. (Also: Iden (Heredity), 26(5):19-22, 1972.)*

The toxic effects of various substances on human beings are discussed. Fetuses are highly susceptible to toxic and mutagenic effects from external causes. The origin, nature, and detection of disturbances in fetuses are mentioned. Several cities with high air pollutant concentrations had higher infant death rates and higher rates of deformed infants and stillbirths. Poisonous heavy metal and inorganic compounds include mercury, lead, sodium selenite, fluorine, and arsenic. Pesticides such as DDT and PCB (polychlorinated biphenyls) also have harmful effects. Mercury and PCB have contaminated rice, fish, and shellfish, foods which mainly constitute the diet of Japanese. Miscellaneous organic compounds such as PCB, detergents, and organic solvents have also affected infants and fetuses. Artificial sweeteners such as cyclamates and sodium glutamate affected laboratory animals.

34712 APTIC NO. 57689

Ross, R. T. and J. G. Gonzalez

THE DIRECT DETERMINATION OF TRACE QUANTITIES OF MANGANESE IN BLOOD AND SERUM SAMPLES USING SELECTIVE VOLATILIZATION AND GRAPHITE TUBE RESERVOIR ATOMIC ABSORPTION SPECTROPHOTOMETRY. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., Primate and Pesticides Effects Lab., 7p., 1973. 12 refs.*

Flameless graphite tube atomizers were used with atomic absorption spectrophotometry to measure trace concentrations of manganese in human urine and serum samples. The concentrations of Mn in serum are near or at the detection limit of the atomic absorption using the conventional flame technique, and the levels in urine and other biological fluids are below the limits of detection. The improved flameless technique improved the detection of the Mn. The mean recovery for blood serum samples was 99.3%. The standard deviations for peak signals from serum, urine, and aqueous samples containing 2.0 micrograms/100 ml of Mn were 2.3, 4.8, and 2.4%, respectively. These data were in good agreement with those cited in literature. No manganese was detected in cerebral spinal fluid. Manganese in blood by the direct method ranged from 0.85-4.05 micrograms/100 ml and by the extraction method ranged from 1.23 to 4.1 micrograms/100 ml. Manganese in the urine ranged from nondetectable quantities to 2.5 micrograms/100 ml with mean Mn concentration of 12.6 micrograms/100 ml. The detection limit for Mn in body fluids was 0.1 microgram/100 ml based on 20 microliter injections of 1:1 serum:water samples into the flameless graphite tube atomizers. Injections of up to 100 microliter samples were possible using this technique, and larger injections increased the sensitivity; however, direct injections of larger sample volumes would increase the amount of nonspecific absorption from the salts present in the biological media causing incorrect manganese readings.

34713 APTIC NO. 57699

Rougee, Michel and Daniel Brault

BINDING OF CARBON MONOXIDE BY DEUTEROHEME IN ORGANIC SOLVENTS. EVIDENCE FOR THE FORMATION OF DICARBONYLDEUTEROHEME IN NON-COORDINATING SOLVENTS. *Biochem. Biophys. Res. Commun., 55(4):1364-1369, 1973. 11 refs.*

The affinity of hemoproteins for carbon monoxide is dependent on the binding of CO to heme, in the absence or the presence of weak or strong field ligands. This was studied using the formation of dicarbonylheme in noncomplexing solvents. In noncoordinating solvents, deuteroheme binds successively two CO molecules. Stability constants of the mono and dicarbonyldeuteroheme are K sub 1 equal to (1.9-2.1) times 10 to the 4th power/M and K sub 2 equal to (1.9-2.1) times 10 squared/M, respectively. In the presence of weak or strong field ligands, monocarbonyl monoligandhemes are obtained. Competition for the axial sixth coordination site (opposite to the first CO ligand) between a second CO and another ligand may favor weak field ligands (depending on their relative concentration), but always favor strong field ligands (quantitative substitution), in the whole accessible range of ligand and CO concentrations. (Author abstract modified)

34714 APTIC NO. 57757

Ruettner, Jacques R., Max A. Spycher, and Hans Sticher

THE DETECTION OF ETIOLOGIC AGENTS IN INTERSTITIAL PULMONARY FIBROSIS. *Hum. Pathol., 4(4):497-512, Dec. 1973. 32 refs.*

The detection of etiologic agents in interstitial pulmonary fibrosis is summarized. Interstitial pulmonary fibrosis may be the result of involuntary inhalation and deposition of small particles of dust in the lung parenchyma as well as the deposition of fumes. The deposited material may induce chronic interstitial pneumonia and lead to interstitial pulmonary fibrosis. No fundamental histologic difference exists between the pathogenesis of some types of interstitial pulmonary fibrosis and classic pneumonoconiosis. In both conditions, fibrous thickening of the alveolar wall is observed with deposition of foreign material. Quantitatively, in classic silicosis, much more dust is involved than in dust-or fume-induced interstitial pulmonary fibrosis. Proper study of the etiology requires the use of different analytical methods that are complementary and allow identification of the smallest amounts of foreign matter. The application of highly specialized procedures as electron microscopy, electron diffraction, x-ray diffraction, and x-ray fluorescence can detect particulate mineral matter to which an individual has been exposed without being occupationally involved. (Author conclusions modified)

34715 APTIC NO. 57742

Scala, R. A. and E. G. Burtis

ACUTE TOXICITY OF A HOMOLOGOUS SERIES OF BRANCHED-CHAIN PRIMARY ALCOHOLS. *Am. Ind. Hyg. Assoc. J., 34(11):493-499, Nov. 1973. 11 refs.*

A series of highly branched primary aliphatic alcohols (amyl, hexyl, isooctyl, 2-ethylhexyl, isononyl, decyl, tridecyl, and hexadecyl) were tested for acute toxicity. The tests included oral and dermal LD50 (lethal dose 50), eye and skin irritation, and 6-hour vapor exposure. Oral LD50 values in rats ranged from 1.5 to greater than 8.4 g/kg and did not show consistent increase with increased molecular weight. Signs of effect were associated with central nervous system depression. Dermal LD50 values in rabbits were all greater than 2.6 or 3.2 g/kg, the highest dose tested, although percutaneous absorption was seen. Skin irritation was slight to severe and generally inversely related to molecular weight. The C5 through C13 alcohols produced moderate to severe eye irritation in rabbits; the C16 alcohol produced only slight irritation. Inhalation toxicity was low, with systemic effects seen only with amyl, 2-ethylhexyl, and isononyl alcohols. Some eye, nose, throat, or respiratory tract irritation was seen with each alcohol. (Author abstract modified)

34716 **APTIC NO. 56960**

Schieler, Leroy

RELATIONSHIPS BETWEEN AIR POLLUTION AND THE HIGH INCIDENCE OF MENTAL DEPRESSION IN WESTERN WASHINGTON. *Preprint, American Chemical Society, 19p. 2 refs. (Presented at the American Chemical Society, Northwest Regional Meeting, Pullman, Wash., June 14-15, 1973.)*

Data is presented which indicate that the high incidence of mental depression in western Washington is due to hydrogen sulfide air pollutants. These pollutants are formed as secondary products in the sulfur cycle in nature, which involves the interconversions of sulfur dioxide, sulfite, sulfate, H2S, and sulfur by soil microorganisms. Geographical areas with low incident sunlight on soil, heavy rainfall, acid soils, large areas of polluted water, and SO2 pollution areas might be expected to have chronic H2S toxicity conditions. The rates of divorce, crime, suicide, and admission to mental hospitals increase with increasing H2S concentrations; the trend is one of high incidences on the west coast, Denver, and scattered industrial midwestern cities, with low incidences on the east coast and southeastern U. S. Similarly, in Sweden, Denmark, and Finland, which have extensive wood pulp industries, the suicide rates are the highest in the world; in Norway, which has no wood pulp industry, the suicide rate is very low. In addition to H2S, mental depression was found to correlate with SO2, carbon monoxide, nitric oxide, and particulates.

34717 **APTIC NO. 57734**

Slob, A.

A NEW METHOD FOR DETERMINATION OF MANDELIC ACID EXCRETION AT LOW LEVEL STYRENE EXPOSURE. *Brit. J. Ind. Med. (London), 30(4):390- 393, Oct. 1973. 13 refs.*

A method is described for the determination of mandelic acid in urine. It is used to determine styrene exposure levels in the air down to 5 mg/cu m. The method is based on ethyl acetate extraction of the urine, followed by a paper chromatographic combined with a gas chromatographic separation. The method was evaluated in industrial situations and compared with a ultraviolet absorption method frequently used previously. The inclusion of a hydrolytic step indicates that part of the mandelic acid is excreted in conjugated form. Workers exposed to styrene levels in the air of less than 5 mg/cu m showed a very significant increase in mandelic acid excretion compared with no exposure conditions. (Author abstract modified)

34718 **APTIC NO. 57710**

Stephens, Robert J., Gustave Freeman, Jerry F. Stara, and David L. Coffin

CYTOLOGIC CHANGES IN DOG LUNGS INDUCED BY CHRONIC EXPOSURE TO OZONE. *Am. J. Pathol., 73(3):711-726, Dec. 1973. 35 refs.*

Beagle dogs exposed for 8 hr/day to 3 ppm ozone for 18 mo showed cytologic changes that indicate metabolic alterations. The endoplasmic reticulum of the type two alveolar epithelial cell in the proximal alveoli were frequently dilated and contained a moderately electron-dense substance having a periodicity of approximately 754 A. This condition was accompanied by a substantial reduction in the lamellar membranes in the characteristic lamellar bodies of the type two cells, suggesting a sequestering of protein in the endoplasmic reticulum. In addition, endothelial cells contained paracrystalline arrays of cytoplasmic membranes not observed in control animals. (Author abstract)

34719 **APTIC NO. 57785**

Stewart, Richard D., Edward D. Baretta, Leigh R. Platte, Elizabeth B. Stewart, John H. Kalbfleisch, Barbara Van Yserloo, and Alfred A. Rimm

CARBOXYHEMOGLOBIN CONCENTRATIONS IN BLOOD FROM DONORS IN CHICAGO, MILWAUKEE, NEW YORK, AND LOS ANGELES. *Science, 182(4119):1362- 1364, Dec. 28, 1973. 11 refs.*

To determine the carbon monoxide exposure experience by the residents of Chicago, Los Angeles, Milwaukee, and New York, venous blood samples were obtained from adults at arbitrarily chosen blood bank collection sites in the four cities and analyzed for circulating carbon monoxide, carboxyhemoglobin. For comparative purposes, blood was obtained from volunteers breathing CO-free air and was found to contain 0.45% COHb. By contrast, a high percentage of all the nonsmoking blood donors breathing city air had carboxyhemoglobin saturations greater than 1.5%, which indicated that exposure to CO in excess of that permitted by the air quality standards of the Clean Air Act of 1971 was widespread and occurring regularly. (Author abstract)

34720 **APTIC NO. 57712**

Ting Shih, Nancy and David H. Petering

MODEL REACTIONS FOR THE STUDY OF THE INTERACTION OF SULFUR DIOXIDE WITH MAMMALIAN ORGANISMS. *Biochem. Biophys. Res. Commun., 55(4):1319-1325, 1973. 22 refs.*

The reactivity of sulfur dioxide s hydrated form, bisulfite, with biomolecules was studied. Formation constants were determined for the reversible reactions of sodium bisulfite with Vitamin K3 and nicotinamide adenine dinucleotide. Cysteine-S-sulfonate did not react with thiamine pyrophosphate or cytidine under a variety of conditions. This places restrictions on the hypothesis that sulfur dioxide may be a mutagen or a carcinogen in mammalian organisms. (Author summary modified)

34721 **APTIC NO. 57316**

Ueshima, Isao, Minoru Tsuda, Tomoichi Okumura, Takashi Tanaka, and Yoshizo Tsunetoshi

SURVEY ON HUMAN EFFECTS OF ODOR AND DUST FROM SEVERAL SOURCES. *(Akushu funjin haishutsu kojo shuhen no jumin kenko chosa). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution) 8(3):487, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 219.)*

Complaints were registered by the residents of a community sandwiched by two national highways and near plants manufacturing polymer adhesive, metal salt, and zinc sheet for acryl acid ester odors and dusts. The Osaka prefectural government conducted a health investigation in August 1972 by a questionnaire and follow-up physical examinations. The questionnaire was given to 1087 families and 805 were returned; examinations were given to 456 persons who complained of symptoms, by otolaryngological, ophthalmological and internal examinations, respiratory function tests, and chest x-ray. Generally, complaints concerning odor and cough were more prevalent when the people were closer to the plants between two highways; but in one area outside one highway but closer factories, the complaints against odor were few (those against coughs were high). With regards to discomfort of nose and throat, complaints were less if the residents were farther away from the highways. Rhinitis, nasal catarrh, and pharyngitis were prevalent and conjunctivitis were prevalent. There were no internal disorders. The health of the residents was damaged by pollution from the plants and automotive exhausts from the highways.

34722 **APTIC NO. 57319**

Ueshima, Isao, Minoru Tsuda, Yasushiro Takemura, Keiichi Kitashoji, and Yoshizo Tsunetoshi

EPIDEMIOLOGICAL SURVEY ON THE EFFECTS OF AIR POLLUTION IN OSAKA. *(Osaka-fu ka ni okeru taiki osen no jumin kenko chosa). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):468, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 220.)*

An epidemiological study of chronic bronchitis was conducted in Takaishi City located in the Osaka Coastal Industrial Area. Of the citizens of Takaishi above 40 years of age, 16,483 were given a questionnaire based on BMRC, and 12,261 (74.4%) responded. Those who complained of subjective symptoms of cough and sputum, 2376, were requested to have physical examinations, and 1030 (43.4%) complied and received examinations of the respiratory system and functions, internal organs, sputum, and chest x-ray. Chronic bronchitis morbidity for males was 8.2% and for females 4.3%, or 6.1% average. Morbidity increased in proportion to the length of residence in the area up to five years, but after that, the curve reached a plateau; this tendency was similar in all age groups. The percentage of obstructive bronchitis was 16.1%, similar to the previous investigations results which were between 15 and 20%.

34723 **APTIC NO. 57753**

Watanabe, Hiroshi and Shichiro Nanjo

EXCESS DEATH STUDY IN HYOGO PREFECTURE. *(Hyogo-kenka no kajo shibo to taiki osen). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):465, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 197.)*

The relationship between excess mortality and sulfur oxides in the Osaka-Kobe area and the Kobe area were investigated. The three-day average of natural deaths (diseases and old age) exceeded the 15-day average plus 1 S.D. figure was considered excess mortality. The sulfur oxide concentration figures for the Kobe-Osaka area was taken from the average of three locations in Amagasaki city, and for the Kobe area, the average of four locations in Kobe were used. When the death rate went up within a week of an SOx concentration exceeding 80 ppb for three days, or when a day s average was more than three times the normal figure, the effect of SOx was considered positive. When the excess mortality of the polluted area overlapped with that of the control area within a one-day lapse before or after, the effect of the weather was considered positive. The control area was the residential area flanking the Kobe-Osaka area with the population of 520,000. In the Kobe area, excess mortality increased drastically between May and October of 1971 from unknown causes. Both SOx and oxidant concentrations were low during this period. In the Osaka-Kobe area, there was an excess death concentration between July and October 1970 from unknown causes. In Amagasaki, the occurrence of excess mortality coincided with high concentration of SOx in 1970 between February and May.

34724 **APTIC NO. 57758**

Watanabe, Hiroshi, Kiyotaka Akimoto, Eiji Kimura, and Hitoshi Kusuda

ON THE STUDY OF HSV ISOLATION FROM ORAL WASHINGS OF SCHOOLCHILDREN IN THE AIR POLLUTED AREA. *(Taiki osen chiiki ni okeru gakudo konai yusugieki yori no tanjun herupesu wirusu bunri ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):470, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 202.)*

The relationship between herpes simplex virus (HSV) and the degree of environmental pollution was examined by separating HSV from oral cleansing water of schoolchildren in various areas of Amagasaki. The tests were conducted in 1970, 1971, and 1972, with fourth, fifth, and sixth graders from a school each in southern (polluted), central (medium polluted), and northern (unpolluted) areas of Amagasaki. Approximately 8 ml of disinfected saline gargling water was given to each child, and the test material was frozen immediately by dry ice, and after diluting the next day, cultured in Eagle MEM, cattle serum 5%, and fungizone for five days at 26 C. Positive cases of HSV were found every day among samples from the southern school, but there was no example of HSV positive in the northern school. The central school had a medium record. There was no seasonal difference, and there was no example of more than two HSV separations from one child. The rate of upper respiratory system disorders was 75% of the total physical health disorders, and the percentages were 41% in the southern school, 34% in the central, and 25% in the northern school. The tendencies of both respiratory dispeases and HSV positives seemed to parallel the degree of pollution by sulfur dioxide and suspended particulates; however, air pollution alone cannot be attributed to the separation rate of HSV.

34725 **APTIC NO. 57288**

Yakubov, B. I.

LUNG CELL PHAGOCYTOSIS AFTER ADMINISTRATION OF SIMPLE AND COMPOUND SULFIDE CONTAINING NICKEL AND COPPER. *(Fagotsitarnaya reaktsiya legkikh pri vvedenii v nikh pyli prostykh i slozhnykh sul fidnykh mineralov, soderzhashchikh nikel i med). Text in Russian. Gigiena i Sanit., no. 9:94-96, 1973. 4 refs.*

The rat lung cell phagocytosis after intracheal administration of 10 mg of millerite and covellite each, 50 mg of chalcopyrite, and 25 mg of pentlandite dust was studied. Cytopathogenic action of nickel and copper, present in the minerals above, was determined. The phagocytic reaction due to nickel-containing dusts was less intense than that induced by copper-containing dusts. The destructive changes of the phagocytes were most pronounced in rats treated with millerite. Formation of abnormal macrophages, and of giant polynuclear cells due the action of millerite was observed.

1972

34726 **APTIC NO. 57383**

Graef, W.

ENVIRONMENTAL HAZARDS DUE TO CARCINOGENIC SUBSTANCES. *(Umweltgefaehrdung durch kanzerogene Substanzen). Text in German. Society for Ecology, Proc. Conf. Load Loadability Ecosystems, Giessen, West Germany, 1972, p. 115-122.*

The problems of endogenous and exogenous carcinogenic substances are discussed with special regard to 3,4-benzo(a)pyrene. Aromatic amines, tar and mineral oil products, chromates, arsenic, and asbestos are regarded as occupational carcinogens. Air pollutants, such as smoke, soot, automotive exhaust, asbestos dust, and tobacco smoke contain specific carcinogenic substances. Among all air pollutants, 3,4-benzo(a)pyrene is regarded as the most ubiquitous carcingenic. The concentrations of 3,4-benzo(a)pyrene reached 6.8 micrograms/100 cu m in London, and 43 micrograms/100 cu cm in Erlangen, West Germany. Natural synthesis of 3,4-benzo(a)pyrene by plants, and the presence of 3,4-benzo(a)pyrene along with seven polycyclic aromatic hydrocarbons in plant materials were observed, which indicates the endogenous nature of these compounds in plants. Such substances were found to act as growth hormones in plants, without increasing the natural residue levels following addition. The residue of level of aromatic polycyclic hydrocarbons in plants amounts to 1-2 micrograms/100 g dry organic material. The natural residue levels in the human organism were in the order of magnitude of 0.5 micrograms/100 g dry substance. Considerable amounts of benzo(a)pyrene in the liver, spleen, kidney, heart, and skeletal musculature of newborn babies were detected. This carcinogenic level that gradually decreases during growth to reach another maximum due to exogenous benzopyrene in adult age, may be endogenous, and act as a kind of growth hormone.

34727 APTIC NO. 57773

Jaffrey, Z., J. Goni, C. Sarcia, G. Bonnemd, and J. Bignon

PHYSICO-CHEMICAL STUDIES OF THE FATE OF CHRYSOTILE IN THE PRESENCE OF ORGANIC ACIDS. PRELIMINARY RESULTS. *(Etudes physico-chimiques de l evolution du chrysotile en presence d acides organiques. Resultats preliminaires).* Text in French. *Rev. Tuberc. Pneumol. (Paris), 36(8):1249-1258, Dec. 1972. 23 refs.*

The lixiviation of chrysotile asbestos under conditions resembling a natural biological medium and the fate of its physical properties in relation to the extraction rate of magnesium in the chrysotile structure were studied. Oxalic lixiviation of magnesium leads to an enormous increase in the internal surface area of the asbestos, from 10 sq m/g to 450 sq m/g, and to almost complete loss of elasticity of the fibers and considerable change in their original morphology. The final body, after loss of magnesium, consists of a silicon dioxide skeleton with remarkable absorptive properties for gases and ionic solutions. These physico-chemical interactions between the mineral and the organic medium, may shed new light on the genesis of ferruginous bodies and on the cytotoxic and carcinogenic effects of asbestos.

34728 APTIC NO. 57299

Juerging, Peter

PICHENS AS BIOINDICATORS OF AIR POLLUTION? (Flechten - Bioindikatoren der Luftverunreinigung)? Text in German. Society for Ecology, Proc. Conf. Load Loadability Ecosystems, Giessen, West Germany, 1972, p. 141-145. 2 refs.

The effects of sulfur dioxide, hydrochloric acid, hydrofluoric acid, carbon monoxide, and ammonia on Hypogymnia physodes, Parmelia sulcata, P. caperata, P. scortea, and Xanthoria parietina were studied in open-air fumigation tests in Munich. Gas and species-specific color changes of all species were observed during the fumigation tests. The species that were not watered showed no damage. Compared with Hypogymnia physodes, Parmelia sulcata and P. scortea featured relatively high resistance against ammonia, CO, SO2, and HF. Hydrochloric acid exerted the strongest and most uniform effect on all species. Transplanted lichen species exposed to an SO2 concentration of 0.1 mg/cu m in winter in Munich showed partial damage, while a lower SO2 concentration of 0.05 mg/cu m in summer was harmless for all species.

34729 APTIC NO. 57300

Kirschbaum, Ulrich

LICHEN DISTRIBUTION SURVEYS IN THE LOWER MAIN REGION FOR THE ACQUISITION OF AIR POLLUTANT CONCENTRATION DATA. *(Flechtenkartierungen in der Region Untermain zur Erfassung von Immissionsbelastungen).* Text in German. *Society for Ecology, Proc. Conf. Load Loadability Ecosystems, Giessen, West Germany, 1972, p. 133-140. 3 refs.*

A systematic study of the distribution of lichen species and populations and of their vitality in a 12,000 sq km area in the Lower Main region in West Germany was performed simultaneously with sulfur dioxide concentration measurements to establish relations between these biological parameters and the pollution level. The only lichen species yet to be found in Frankfurt and its vicinity is Lecanora varia. This area is surrounded by a zone featuring lichen indices ranging from 1 to 45. Respective zones in which SO2 concentrations of 0.095, 0.084, 0.079, and 0.064 mg/cu m were measured featured lichen indices of 0, 1-45, 45-100, and 100-200. Epiphytic lichens were not found in areas where SO2 mean concentrations over 0.10 mg/ cu m were measured. Increases in both the number of species, their population density and vitality with reducing SO2 levels were observed. Parmelia sulcata, P. exasperatula, Hypogymnia physodes, Candelariella xanthostigma, Physcia orbicularis, and Lecanora subfusca are rated as species of average susceptibility, while Parmelia acetabulum, P scortea, P. dubia, P. saxatilis, Xanthoria parietina, Physcia ciliaris, Ramalina pollinaria, and Evernia prunastri are endangered species.

34730 APTIC NO. 57288

Kocher, H.-J. and W. Loetschert

THE PH VALUE AND SULFUR CONTENT OF TREE BARK AS INDICATORS OF AIR POLLUTION IN THE URBAN-INDUSTRIAL ECOSYSTEM AROUND FRANKFURT A.M. *(pH-Wert und S-Gehalt der Baumborke als Indikatoren fuer Luftverunreinigung im urban-industriellen Oekosystem um Frankfurt a.M.).* Text in German. *Society for Ecology, Proc. Conf. Load Loadability Ecosystems, Giessen, West Germany, 1972, p. 147-152. 8 refs.*

The pH value and sulfur contents in barks of Acer platanoides, Fraxinus excelsior, and Tilia platyphyllos growing in and around Frankfurt a.M. were determined in a study of the suitability of these species for use as indicators of air pollution. An increase in the pH values of the bark extracts, and a decrease in the S content with increasing distance of the test trees from the center city were determined. The pH values in bark samples from Acer platanoides, Fraxinus excelsior, and Tilia platyphyllos were in the respective ranges of 3.42-4.35; 3.12-4.21, and 2.72-3.74. The highest S content on the surface of one bark sample was 250 micrograms/sq cm. The pH values increased, and the S contents decreased from the outside to the inside of the bark. Linear relationships between the variations in the pH values and the S content as a function of the distance from the center city were determined. Absorption of sulfur dioxide on the bark surface, and catalysis of the SO2-to-sulfur trioxide conversion by the bark are assumed. The findings indicate the suitability of these species as indicators of air pollution by bark pH and S content measurements.

34731 APTIC NO. 57115

Leibetseder, J., M. Skalicky, and A. Kment

IN VITRO UPTAKE OF 65 ZN BY ERYTHROCYTES FOR DIAGNOSIS OF ZINC DEFICIENCY. *(65 Zn Erythrozyten-Uptake in vitro zur Diagnose des Zinkmangels). Strahlentherapi (Munich), vol. 72:383-388, 1972. 18 refs. Translated from German, 10p.*

The zinc uptake by pig erythrocytes was investigated for diagnosis of Zn deficiency. As the calcium content of the fodder reinforces the Zn deficiency symptoms, the Ca content was considered. Twenty castrated male pigs were divided into five weighed groups and fed a restricted diet by groups which varied by Zn and Ca content. The (65) Zn uptake of the erythrocytes appears to be correlated best with the level of the oral Zn supplement. The groups without Zn supplement showed the highest (65) Zn uptake. The increased Ca content of the feed increased this effect considerably. The differing levels of Zn supplements in three groups has no effect on the erythrocyte uptake.

34732 APTIC NO. 57616

Morgan, Jean M.

HEPATIC COPPER, MANGANESE, AND CHROMIUM CONTENT IN BRONCHOGENIC CARCINOMA. *Cancer, 29(3):710-713, March 1972. 25 refs.*

A significant increase in serum, hepatic, and renal cadmium has previously been reported in association with bronchogenic carcinoma and emphysema. To test the specificity of such findings, hepatic concentrations of copper, manganese, and chromium were studied in the same patients. There was no significant alteration in hepatic Mn or Cu in association with either bronchogenic carcinoma or emphysema alone, but a slight increase in Mn concentration was noted when both diseases were present. Hepatic Cr was very low in conjunction with bronchogenic carcinoma, but the reason for this was not apparent. (Author abstract)

1971

34733 **APTIC NO. 57445**

Allison, A. C.

EFFECTS OF SILICA AND ASBESTOS ON CELLS IN CULTURE. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:437-445, 1971. 26 refs. (Sept. 14-23.)*

Past work is cited showing silica particles do not damage macrophages by interaction with plasma membranes, but are ingested into secondary lysosomes. A hydrogen-bonding interaction with membrane phospholipids makes the lysosomal membrane permeable, and this on a large scale is damaging. Protection against silica toxicity can be achieved by polymers which are stored in lysosomes and have hydrogen-accepting groups, such as polyvinylpyridinio-acetic acid. Asbestos varieties, especially chrysotile, added to macrophages or mesothelial cells in the absence of serum rapidly lyse the cells by interaction with the plasma membrane. In the presence of serum, the particles are much less damaging than silica, irrespective of whether they are ingested into the lysosomal system, which happens if they are short enough. An experiment on the effect of various asbestos dusts on mouse peritoneal macrophages and on organ cultures of mouse peritoneum in calf serum are described. Independently of asbestos type, short fibers (less than 5 micron) were readily and completely taken up by phagocytosis, whereas long fibers (greater than 30 micron) were not. When asbestos fibers were added to macrophages in buffered saline lacking serum, marked cytotoxic effects occurred. (Author abstract modified)

34734 **APTIC NO. 57449**

Beck, E. G., J. Bruch, K.-H. Friedrichs, W. Hilscher, and F. Pott

FIBROUS SILICATES IN ANIMAL EXPERIMENTS AND CELL-CULTURE – MORPHOLOGICAL CELL AND TISSUE REACTIONS ACCORDING TO DIFFERENT PHYSICAL CHEMICAL INFLUENCES. *Text in German. British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:477-487, 1971. 8 refs. (Sept. 14-23.)*

Rats were exposed intraperitoneally to different types of asbestos having various fiber lengths. Asbestosis was produced mainly by long fibers. In another experiment, rats were given UICC amphiboles (amosite, crocidolite, and anthophyllite) intraperitoneally. The percentage of long fibers in the ashed sections of the granulomata was relatively higher than in the original dust. In the lymph nodes, mainly the short fibers were deposited. These results suggest that the short fiber fraction is readily transported by the lymphatic channels. Long asbestos and glass fibers produced a rise in the permeability of cells from monolayer or suspension cultures of line-L. This could be attributed to slower and incomplete phagocytosis of the longer fibers.

34735 **APTIC NO. 57435**

Borisenkova, R. V. and T. A. Kochetkova

FIBROGENICITY OF DUST IN DIFFERENT REGIMENS OF INTRODUCTION INTO THE ORGANISM. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:329-335, 1971. 7 refs. (Sept. 14-23.)*

The significance of intermittent intake of dust in different concentrations was studied in terms of development of fibrosis of lungs in albino rats during inhalation of polymetallic ore (containing 36.8% free silicon dioxide and 32.8% bound SiO_2; 14.7% alumina; 3.26% ferric oxide; 2.2% ferrous oxide; 0.84% calcium oxide; 0.53% copper; and 0.66% sulfur) and quartz dust (98% free SiO_2). One group was exposed continually to 50-100 mg/cu m for 3 hr/day, another group was exposed to 250-500 mg/cu m at regular intervals of several days, and the third group was exposed to the high concentrations for 3 hr/day for 25-40 days in two periods with an intermission of 5 mo. Dust caused diffuse proliferative process of silicatosis and upper respiratory tract catarrh. Increase of duration of inhalation in all groups resulted in enhancement of the process. Sclerosis seemed dependent on the mixed composition of the dust. Changes of intracellular structures and lung clearance were noted. Exposure to higher concentrations for a shorter time resulted in more pronounced change in the upper respiratory tract. Quartz caused development of nodular or mixed forms of silicosis. By the end of the experiment, the animals of the first group had large and partly merged silicotic nodules. Animals of the second group had moderately manifested thickening of interalveolar septa due to proliferation of cellular elements and partial sclerosis accompanied by the nodular process. Animals of the third group had increased lung weight and paratracheal bifurcation lymph node weight and increased total lipid and oxyproline content. Intermissions were of positive effect, since they assisted in elimination of dust and lessening of the process to some extent.

34736 **APTIC NO. 57427**

Brain, Joseph D.

THE EFFECTS OF INCREASED PARTICLES ON THE NUMBER OF ALVEOLAR MACROPHAGES. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:209-225, 1971. 30 refs. (Sept. 14-23.)*

A method was developed which quantifies alveolar macrophages in the lungs. It was used to examine the effects of intratracheally injected particles on the number of alveolar macrophages harvested by lung washing. The effects of variables such as gas-freeing the lungs, post-mortem delay times, wash volume, temperature, composition of washing fluid, time course of washing cycle, pathological changes, age, sex, lung weight, and body weight are mentioned. Anesthetized rats or hamsters were given intratracheal injections of particles suspended in saline and subsequently dispersed ultrasonically. Four hours, 1 day, or 3 days following the injection, the animals were exsanguinated and the lungs excised, gas-freed, cannulated, and washed 12 times. The volume of each saline wash was five times greater than the tissue volume. The cells in the lung washings were counted in a hemacytometer chamber. Dose-response relationships and time- response relationships were explored. In general, the increase in free cells was maximal 1 day after injection but was also elevated from control levels at 4 hr and 3 days. Coal dust, carbon, chrysotile, iron oxide, and barium sulfate were all associated with an increase in the recovery of free cells. When the particle size of the coal dust was reduced while the total mass was kept constant, the response was enhanced. External massage of the lung was associated with increased recovery of free cells, as was the absence of divalent cations from the washing medium. Data related to the importance of repeated washings is given. The volumes of saline retained by the lung during the wash procedure is discussed. (Author abstract modified)

34737 **APTIC NO. 57446**

Bruch, J.

ELECTRON MICROSCOPIC OBSERVATIONS ON QUARTZ DUST PHAGOCYTOSIS. *(Elektronenmikrosokopische Beobachtungen zur Quarzstaubphagozytose). Text in German. British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:447-451, 1971. 10 refs. (Sept. 14-23.)*

During quartz phagocytosis, alveolar macrophages and histiocytes membrane organelles are involved in the phagocytic process. These organelles with a diameter of 41 nm consist of an 11 nm thick inner membrane and two triple-layered limiting membranes. Depending upon the orientation in the section plane, the inner membrane gives a pentalaminar, cross-striated, or a globular appearance with a center-to-center distance of 4.7 nm. It is likely that the underlying substructure is a double layer of hexagonally arranged subunits with a diameter of 5.5 nm. Quartz, entering the cell in a phagosome, leaves the vacuole and lies free in the ground plasma. Subsequently, the particle is trapped by the cupshaped organelle. Morphological findings indicate that the inner membrane of the membrane organelle participates in the formation of the secondary lysosome. Whether a lysosomal damage is causally related to a direct quartz action or whether it is a secondary event is discussed.

34738 **APTIC NO. 57426**

Camner, P. and K. Philipson

INTRA-INDIVIDUAL STUDIES OF TRACHEOBRONCHIAL CLEARANCE IN MAN USING FLUOROCARBON RESIN PARTICLES TAGGED WITH 18F AND 99MTC. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:157-163, 1971. 9 refs. (Sept. 14-23.)*

Human tracheobronchial clearance was studied with a test aerosol of 6-7 micron particles of fluorinated ethylene propylene (Teflon 120, Dupont) tagged with fluorine(18) and technetium(99m). Eight nonsmokers without lung disease were exposed twice within a few days. The intra-individual differences in clearance were small compared to the inter-individual differences. The lung clearance pattern was to a great extent dependent on inhalation of test aerosol and to a certain extent on particle size within the range of 4.9-7.8 micron. Lung clearance was studied in a small group of smokers during normal smoking, during acute exposure to tobacco, and about a week after they had stopped smoking. There was no tendency to reduce clearance in acute exposure; two of six persons had a striking increase. Consistently slow clearance occurred a week after the subjects stopped smoking. A study was made of four persons suffering from lung disease. In these exposures, biological half-life times were 12, 18, 61, and 28 minutes.

34739 **APTIC NO. 57264**

Chataigneau, P. and M. Rabier

CANCERS OF THE RESPIRATORY TRACT. PART 1 - PRIMARY CANCERS. *(Cancers de l appareil respiratoire. I. - Les cancers primitifs). Text in French. Med. Afr. Noire, 18(5):425-430, 1971. 20 refs.*

An epidemiologic and pathomorphologic study of bronchopulmonary cancers in Dakar is presented. The occurrence of bronchopulmonary cancers is, though rather low, steadily increasing. All of the 131 cases were male, in the age bracket from 30 to 69 years, with a maximum in the age bracket of 40-49 years. Many of the patients were smokers. Histologically, 46% of all cases were epidermoid, 33% anaplasic, 4% cylindric, and another 17% miscellaneous. With air pollution practically nonexistant, the ever-increasing use of tobacco is regarded as one of the main etiological factors in the increase in the occurrence of primary bronchopulmonary cancers.

34740 **APTIC NO. 57450**

Conning, D. M., M. J. Hayes, J. A. Styles, and J. A. Nicholas

COMPARISON BETWEEN IN VITRO TOXICITY OF DUSTS OF CERTAIN POLYMERS AND MINERALS AND THEIR FIBROGENICITY. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:499-506, 1971. 6 refs. (Sept. 14-23.)*

A comparison was made of the ability of asbestos, polyurethane, polyethylene terephthalate (PEP), and acicular calcium carbonate (aragonite) dusts to produce progressive or persistent fibrosis after intraperitoneal or intratracheal injection in rats, and of their cytotoxic activity to alveolar and peritoneal macrophages in culture. The dusts were paired for the presence and absence of cytotoxicity (asbestos and PEP), particle shape (polyurethane and PEP; asbestos and aragonite), and nature (mineral or polymer). The greatest mortality was shown by cells treated with asbestos and least by cells treated with PEP. Intermediate levels of activity occurred with polyurethane and aragonite. With polyurethane, the fine material was almost twice as lethal as the coarse. All dusts except coarse polyurethane were ingested to the same degree. Coarse polyurethane showed reduced phagocytosis at 1 hr, but reached levels comparable to other dusts at 2 hr. Asbestos was ingested normally at 1 hr, but showed reduced phagocytosis at 2 hr. Aragonite and PEP were present in less than 10% of the peritoneal macrophages. Polyurethane was present in 15-25% of cells staining with trypan blue; asbestos was present in more than 40% of the dead cells. The results were similar with those obtained with alveolar macrophages, but the number of dead cells were larger. Fibrosis measured by degree of reticulin deposition after 3 mo was greatest with asbestos, least with aragonite and PEP, and intermediate with fine polyurethane. There was a direct relationship between cytotoxicity to macrophages in culture and fibrogenicity in living animals; this relationship was independent of particle shape, size, or concentration, or of the phagocytic potential. The test described might be a useful screening process for dusts of plastic materials. (Author abstract modified)

34741 **APTIC NO. 57437**

Dale, Knut

LUNG FUNCTION STUDIES IN EXPERIMENTAL SILICOSIS WITH RADIOSPIROMETRIC TECHNIQUE AND SOME OBSERVATIONS ON A TECHNIQUE FOR INDUCING UNILATERAL SILICOSIS. A PRELIMINARY REPORT. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:347-356, 1971. 14 refs. (Sept. 14-23.)*

An injection technique was used to deposit a known amount of quartz dust in the right lung of rabbits while the left lung remained free from particles. Using the animal s left lung as a control, the wet weight of the lung provided a good quantitative measure of the fibrogenetic effect of quartz. It appeared that 50-100 mg of quartz caused no increase in the absolute collagen content of the lung after 6 mo. A radiospirometric technique for lung function studies is described. Using this, no demonstrable reduction of perfusion or ventilation in the right lung compared with the left was found 6 mo after injection of 150 mg of quartz in the right lung. The silicosis in the rabbit s right lung was demonstrated radiographically on inflated lung preparations and histologically. (Author abstract modified)

34742 **APTIC NO. 57443**

Daniel, H., J. C. Martin, and L. Le Bouffant

THE ACTION OF ALUMINUM COMPOUNDS ON THE FORMATION AND EVOLUTION OF EXPERIMENTALLY INDUCED SILICOTIC LESIONS. *(Action de composes de l aluminium sur la formation et l evolution de lesions silicotiques experimentales). Text in French.*

British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:415-421, 1971. 2 refs. (Sept. 14-23.)

Aerosols containing aluminum chlorhydroxyallantoinate or aluminum hydroxide can be used to prevent the formation of silicotic lesions produced by the inhalation of quartz dust by rats. The efficiency of this treatment was tested in experiments over 14 mo. Prevention was complete for 5 mg of Al compound (calculated as alumina)/cu m in the case of an average dusting of about 6 mg of quartz per lung. For every high concentrations – for instance 12 mg of quartz per lung – complete protection could be achieved using amounts of aerosols greater than 5 mg/cu m or longer lasting treatments. Evolution of already formed lesions was stopped by the same treatment. The aerosols used showed no toxicity for the lung.

34743 **APTIC NO. 57428**

Dennis, W. L.

THE EFFECT OF BREATHING RATE ON THE DEPOSITION OF PARTICLES IN THE HUMAN RESPIRATORY SYSTEM. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:91-103, 1971. 16 refs. (Sept. 14-23.)*

Test clouds of aerosols having a mass median diameter of about 5 micron and a number median diameter of about 1 micron, generated with a conventional jet type spray from either melted stearic acid or a suspension of calcium carbonate were emitted to humans through a facemask with a respiratory valve. The test apparatus, respiratory valve, and instrumentation are described. The effect of increasing the breathing rate on the deposition in inhaled particles in the human respiratory system depended upon the method used to increase the rate. If the rate was increased artifically and the minute volume remained almost constant, the deposition decreased up to a respiration rate of about 15-20/min. If the subject was exercising, the minute volume increased with respiration rate as did the percentage deposition. There were large individual variations in the depositions, probably due to different breathing patterns; mean values for a large number of subjects may conceal the effect of varying certain parameters. (Author abstract modified)

34744 **APTIC NO. 57469**

Felczak, Jan

PNEUMOCONIOSIS IN SHIPYARD WORKERS AND EXPERIMENTAL STUDY OF THE EFFECT OF SMOKE AND DUST ON THE RAT LUNG TISSUE. *(Pneumoconiose des travailleurs de l industric navale et experimentation sur l influence des fumees et poussieres dur le tissu pulmonaire des rats). Text in French. British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 2:967-974, 1971. 22 refs. (Sept. 14-23.)*

The thoraxes of 2250 shipyard workers were examined radiologically. The x-rays were assessed according to the international classification of pneumoconiosis. The results were: 76% (1700 workers) with no change; 12% (270 workers) with suspicion of pneumoconiosis; 1% (23 cases) with linear shadows; 10% (230 cases) with punctiform pneumoconiosis; and 1% (27 cases) with micro-nodulous form. Experimental examinations were carried out on white rats exposed in experimental chambers and at the working posts of welders and maintenance painters. X-rays were taken before and after the experiments for comparison with dissection and histopathological results. On the basis of radiological examinations of the thoraxes of the humans and the rats, and of histopathological examinations of animals, the changes in the lungs corresponded to sidero-silicosis.

34745 **APTIC NO. 57463**

Gibbs, G. W.

QUALITATIVE ASPECTS OF DUST EXPOSURE IN THE QUEBEC ASBESTOS MINING AND MILLING INDUSTRY. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 2:783-799, 1971. 69 refs. (Sept. 14-23.)*

Recent epidemiological studies of workers in the Quebec asbestos mining and milling industry described relationships between dust exposure and indices of health. The quality as well as the quantity of dust to which workers are exposed varies within and between mining operations. Therefore, some of these qualitative factors were studied with particular reference to organic constituents, trace metals, dust mineralogy, and radioactivity. Levels of airborne polycyclic aromatic hydrocarbons in mills and levels of radon daughters in underground mines were considered too low to play any significant role in the lung cancer mortality in this industry. The trace metal content of commercial fiber varied between mines, and airborne trace metal concentrations in the three mills investigated exceeded levels reported for textile plants. Trace metal content was measured in total and respirable airborne dust in different areas of the mills. The importance of dust chemistry, physics, and mineralogy in experimental and epidemiological studies of the effects of asbestos is discussed. (Author abstract modified)

34746 **APTIC NO. 57432**

Goethe, Carl-Johan and Ake Swensson

INFLUENCE OF BCG ON LYMPHATIC LUNG CLEARANCE IN RATS. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:293-299, 1971. 18 refs. (Sept. 14-23.)*

Rats were injected intratracheally with 1 ml of a suspension of mineral particles and injected intraveneously with low-virulent tubercle bacilli (BCG). The mineral particles studied included quartz particles with mean diameters of .4 micron (about 85% of the particles were smaller than 0.5 micron), quartz particles with mean diameters of 1.2 micron (nearly all particles were below 3 micron), quartz particles with mean diameters of 3.9 micron (nearly all between 3 and 9 micron), titanium dioxide particles with mean diameters of 0.6 micron, diatomaceous earth particles mostly smaller than 5 micron, diatomaceous earth heated to 400 C for 24 hr, and diatomaceous earth heated to 800 C for 24 hr. The BCG Retarded the elimination of mineral particles from the lungs and from the whole lung-hilar lymph node system. The BCG also retarded the translocation of particles from the lungs to the regional lymph nodes. This applied to all types of mineral particles studied irrespective of the particle dosage, the fibrogenicity of the particles, and whether the particles contained silicon dioxide or not. (Author abstract modified)

34747 **APTIC NO. 57457**

Gross, Paul, Lewis J. Cralley, John M. G. Davies, Robert T. P. de Treville, and Jiri Tuma

A QUANTITATIVE STUDY OF FIBROUS DUST IN THE LUNGS OF CITY DWELLERS. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 2:671-681, 1971. 9 refs. (Sept. 14-23.)*

The lungs of adult Pittsburghers contained from 15,00 to nearly 400,000 inorganic fibers/g of lung. The fibers ranged from 1.9 to 3.1 micron in mean diameter and from 18 to 38 micron in length. There was no relation of the fiber count to the total dust content of the lungs which ranged from 0.6-6.1% of their weight. The lungs of a 6-year-old child had an unexpectedly high fiber count, 89,000/g of lung. The ash of tissue paper contained fibers similar to those found in the lungs, in an amount equivalent to 7500 fibers/g of paper. The size distribution of the fibers from the paper ash was similar to that of fibers isolated from the lungs. The number of ferruginous bodies was related neither to the fiber count nor to the total dust content of the lungs. The ferruginous bodies ranged from 28 to nearly 4000 per gram of lung. (Author abstract modified)

34748 **APTIC NO. 57439**

Gruenspan, M. and H. Antweiler

BIOCHEMICAL AND BIOPHYSICAL REACTIONS OF RAT LUNG TISSUE TO QUARTZ AND CORUNDUM WITH AND WITHOUT PVN-OXIDE TREATMENT. *Text in German. British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:373-378, 1971. 7 refs. (Sept. 14-23.)*

Rats were treated by intratracheal injection of 20 mg quartz or corundum in saline suspension and 2 hr later by intravenous injection of 2 mg of polyvinylpyridine-N-oxide (PVNO). Lung weight, quartz and PVNO content, and phospholipid substances of the lungs were estimated at various intervals after the injections. Up to 30 days after application, quartz-lungs contained much more PVNO than lungs of quartz-free animals. The amount of PVNO in quartz-lungs surpassed the theoretically possible maximum of PVNO adsorption on the quartz found in these rats. Corundum did not show the same effect. Thus, quartz induced the development of special adsorbent receptors for PVNO, possibly in macrophages. Furthermore, the amount of phospholipids in quartz-lungs was markedly increased, while in quartz plus PVNO-treated lungs the phospholipids increased only moderately. Thus, the phospholipids may be a good indicator of the extent of the necrosis of quartz-macrophages.

34749 **APTIC NO. 57452**

Henry, Mary C., James Spangler, John Findlay, and Richard Ehrlich

EFFECTS OF NITROGEN DIOXIDE AND TOBACCO SMOKE ON RETENTION OF INHALED BACTERIA. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:527-533, 1971. 8 refs. (Sept. 14-23.)*

An acute 2-hour exposure to 15 ppm of nitrogen dioxide followed by a 1-hour exposure to 3% (v/v) cigarette smoke significantly decreased the resistance of hamsters to bacterial pneumonia initiated by respiratory challenge with airborne Klebsiella pneumoniae. The change in resistance was demonstrated by enhanced mortality and decreased survival time. The effect of the combined exposures was significantly greater then that produced by exposures to either pollutant alone. The combined exposure also reduced the rate of clearance of viable bacteria from the lungs to a greater extent that single exposures. (Author abstract)

34750 **APTIC NO. 57430**

Heppleston, A. G., G. W. Civil, and A. Critchlow

THE EFFECTS OF DURATION AND INTERMITTENCY OF EXPOSURE ON THE ELIMINATION OF AIRBORNE DUST FROM HIGH AND LOW RANK COAL MINES. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:261-271, 1971. 8 refs. (Sept. 14-23.)*

Rats were used to determine the elimination and retention of airborne dust from high and low rank coal mines. The rats were exposed in dust chambers for 16 hr/day, 5 days/wk in continuous and intermittent exposures. The lungs and lymph nodes of each rat were analyzed separately for coal content. Overall, the long term clearance of low rank dust tended to be greater than high rank, although a peculiar macrophage reaction to low rank dust may have affected its removal from the lung. Only with high rank dust was there any indication that clearance after short or intermittent inhalations was better than after long or continuous ones. The results were analyzed statistically. (Author summary modified)

34751 **APTIC NO. 57426**

Heppleston, A. G.

OBSERVATIONS ON THE MECHANISM OF SILICOTIC FIBROGENESIS. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London England, 1970, vol. 1:357-371, 1971. 36 refs. (Sept. 14-23.)*

In order to isolate the process of phagocytosis from that of fibrosis, rat peritoneal macrophages were incubated for 24 hr with quartz particles. Cultures of chick embryo fibroblasts, explanted 3-4 days previously and maintained under the same conditions as the macrophages, were employed as the test system. The DNA level was used as an indicator of cell proliferation; the object was to assess whether hydroxyproline (HOP) formation under the influence of the macrophage extracts was related to an increased population of fibroblasts or to augmented functional activity of a static population. If the results were expressed as ratios between the levels of HOP and of DNA in the same cultures, a much higher value was obtained for the macrophage/ quartz extract than for any of the control procedures. The same culture system was utilized to investigate the influence of polyvinylpyridine-N-oxide (PNO) on the production of HOP. The production of HOP was inhibited. In tests with titanium dioxide, no change occurred. The inhibitory effect of PNO on the cytotoxicity and fibrogenicity of silica could be interpreted as showing the effect of the dust depends on the damage to cell membranes. However, non-lipid fibrogenic factors and reticuloendothelial-stimulating lipid factors were also involved. Sustained collagen production probably requires fresh generations of fibroblasts. If they are derived from macrophages, the lipid factors could serve a dual role in providing the cellular elements for both the development of the fibrogenic factors and for their target. This hypothesis could embrace in outline mechanisms of fibrogenesis by other agents which like silica evoke a macrophage response and are cytotoxic.

34752 **APTIC NO. 57418**

Hounam, R. F., A. Black, and M. Walsh

THE DEPOSITION OF AEROSOL PARTICLES IN THE NASOPHARYNGEAL REGION OF THE HUMAN RESPIRATORY TRACT. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:71-80, 1971. 10 refs. (Sept. 14- 23.)*

Experiments were conducted to measure the deposition of radioactive, monodisperse polystyrene particles between 1 and 10 micron in diameter aspirated through the nose and mouth at known flow rates. The arrangements permitted the pressure difference across the nose and mouth to be determined as deposition occurred. The apparatus for the production and administration of the test aerosol, bromine-82 labelled polystyrene particles, is described. Deposition measurements were made on three subjects at flow rates of 5, 10, 20, 30, and 37 l/min. When deposition of particles of the same size was plotted against flow rate, there was considerable scatter in the results. A much closer relationship was found with the pressure difference. The results show some divergence from the relationship proposed by the Task Group on Lung Dynamics. An alternative working relationship is suggested. (Author abstract modified)

34753 **APTIC NO. 57424**

Iravani, J.

CLEARANCE FUNCTION OF THE RESPIRATORY CILIATED EPITHELIUM IN NORMAL AND BRONCHITIC RATS. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:143-148, 1971. 11 refs. (Sept. 14-23.)*

An in vitro method of studying the mucociliary clearance function in the entire intact tracheobronchial tree of the rat was developed. The method was used to study mucociliary activity in the intact tracheobronchial wall by light microscopy. Normal rats and rats with bronchitis were examined. In spontaneously occurring bronchitis in rats, the pathology was generally localized in patchy areas, and the intervening ciliated epithelium exhibited normal function at times, but was more frequently hyperactive. Specific abnormalities of the ciliar mechanism were associated with bronchitis. These were inactive ciliated cells and alterations in some characteristic features of ciliary movement. The primary event in the pathogenesis of bronchitis seems to be the occurrence of an abnormality in the ciliary mechanism. A variety of specific or non-specific stimuli may impair ciliary function and allow the penetration of viral or bacterial agents which give rise to the classical inflammatory processes.

34754 **APTIC NO. 57431**

Klosterkoetter, W. and F. Gono

LONG-TERM STORAGE, MIGRATION AND ELIMINATION OF DUST IN THE LUNGS OF ANIMALS, WITH SPECIAL RESPECT TO THE INFLUENCE OF POLYVINYL- PYRIDINE-N-OXIDE. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London England, 1970, vol. 1:273-281, 1971. 10 refs. (Sept. 14-23.)*

Rats were exposed to long-term inhalations of 1 mg/cu m quartz dust for 1 yr, 5 hr/day, 5 day/wk. This caused typical silicosis. The elimination 3 and 6 mo after termination of the exposure was very low. In a second test, rats inhaled only titanium dioxide, TiO2 plus quartz, TiO2 plus quartz plus polyvinyl-pyridine-N- oxide (PNO), or TiO2 plus PNO. Quartz significantly increased the retention and penetration of TiO2. This quartz effect was suspended by inhalation of PNO. The elimination of TiO2 was not promoted by PNO. A third long-term elimination test consisted of inhalation 30 mg/cu m of quartz for 3 days, 5 hr/day or for 10 days, 5 hr/day. The retention, elimination, and penetration were observed for 15 mo after exposure. The biological half-life value was about 3 mo. The further development of the elimination curve differed essentially from the curve for the exponential half-life time. The initial dust load of the lungs influenced the retention and the elimination. (Author abstract modified)

34755 **APTIC NO. 57458**

Langer, A. M., V. Baden, E. C. Hammond, and I. J. Selikoff

INORGANIC FIBERS, INCLUDING CHRYSOTILE, IN LUNGS AT AUTOPSY: PRELIMINARY REPORT. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 2:683-694, 1971. 31 refs. (Sept. 14-23.)*

Optically visible asbestos bodies represent only a selected fraction of the inorganic fibrous particles in the lungs of city dwellers. Microscopic examination of lung sections in 3000 consecutive autopsies of New York City residents showed uncoated inorganic fibers commonly present, including fibers narrower than 1.0 micron diameter in 1038 cases. In 1551 cases, no asbestos bodies were seen; in 1168 cases, thin fibers were absent. Thus, chrysotile asbestos is commonly found in the lungs of New York City residents. Twenty-eight consecutive cases were studied by electron microscopy. Chrysotile fibers or fibrils were found in every specimen. In four of the cases, background contaimination could have been responsible for the findings. In 24 of the 28, the number found was greater than background could explain. Technical factors indicate that analysis of asbestos body cores is unlikely to provide accurate and complete information concerning the asbestos fiber burden of the lung. Instead, direct, unique identification of chrysotile fibers and fibrils by electron microscopy will be useful. (Author abstract modified)

34756 **APTIC NO. 57428**

Le Bouffant, L.

INFLUENCE OF THE NATURE OF DUST AND OF THE PULMONARY LOAD ON CLEARANCE. *(Influence de la nature des poussieres et de la charge pulmonaire sur l epuration). Text in French. British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:227-246, 1971. 6 refs. (Sept. 14-23.)*

The inhalation of dusts by different kinds of rats and cats was studied to show that lung clearance depends on the nature of the dust and varies according to the animal species. From a reference lung clearance curve established with activated haematite, it was possible to determine the influence of various factors, such as pulmonary dust load, time since exposure, or nature of particles, on the lung clearance capacity at a given time. The inhalation of coal, even in small quantities, led to a decrease of alveolar clearance in rats. After heavy doses of dust, the rate of alveolar clearance became negligibly small; moreover the clearance function did not recover appreciably. Inhaled quartz decreased the rate of lung clearance in the same way, but the clearance activity partly recovered. After a long time following quartz inhalation, alveolar retention showed a marked reduction because of a decrease in alveolar accessibility due to quartz lesions.

34757 **APTIC NO. 57421**

Lippmann, Morton, Roy E. Albert, and Harold T. Peterson, Jr.

THE REGIONAL DEPOSITION OF INHALED AEROSOLS IN MAN. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:105-122, 1971. 19 refs. (Sept. 14-23.)*

Direct measurements of regional aerosol deposition in man were made using insoluble monodisperse test aerosols, tagged with gamma-emitted isotopes, and an array of external scintillation detectors. On the basis of the retention measurements made immediately after the test aerosol inhalation, the aerosol can be subdivided into a number of component fractions, i.e., the head deposit, tracheal deposit, whole lung deposit, and exhaled aerosol. Part of the whole lung deposit is rapidly cleared by mucociliary transport within 24 hr, while the balance is cleared at a slower rate. The part which clears rapidly has been equated with tracheobronchial (TB) deposition and the residual deposit with alveolar deposition. Over 200 tests on 65 subjects, including 14 nonsmokers, 29 current cigarette smokers, six bronchitic patients, and one asthmatic, were performed. For aerosols with aerodynamic diameters greater than 2 micron, deposition in the head and larger airways was due primarily to the impaction mechanism. For smaller particles in normals, gravitational sedimentation on the smaller airways of the mucous escalator became a major component of the TB deposit. The TB deposition for a given particle size varied greatly from subject to subject, but each individual had a characteristic size versus deposition relation. The TB deposition of 1-5 micron diameter particles was very much higher in the asthmatic and bronchitic patients than in the nonsmoking normals, and most of the increase was in airways beyond the trachea. As a group, the current cigarette smokers had higher tracheal and overall TB depositions than the nonsmokers, although the differences were smaller than for the bronchitic patients; the data for the group overlapped part of the broad normal range. (Author abstract)

34758 **APTIC NO. 57423**

Love, R. G., D. C. F. Muir, and K. F. Sweetland

AEROSOL DEPOSITION IN THE LUNGS OF COAL WORKERS. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:131-139, 1971. 17 refs. (Sept. 14-23.)*

Measurements of the deposition of 1 micron diameter aerosols in the lungs of two groups of coal workers with and without simple pneumoconiosis were carried out during steady state breathing using a modified La Mer-Sinclair generator. X-rays were examined and lung functions were studied during tests on a bicycle ergometer. Average percentage deposition was calculated for each subject at four workloads, and the results were graphically plotted against tidal volume. In the majority of cases, deposition increased or showed little change with tidal volume, while a few subjects showed a slightly decreased deposition as tidal volume increased. At a standardized tidal volume of 1.6 l, the mean deposition was 20.9% for the control group and 21.3% for the pneumoconiotic group. The average deposition at tidal volumes of 1.0 and 2.2 l was 19.8% and 22.1% for the normal group and 19.4% and 23.1% for the pneumoconiotics, the latter being a slightly greater but insignificant rate of increase of deposition with volume. Therefore at tidal volumes within the normal working range, there was no more than a difference of 1% fractional deposition between the two groups. Pneumoconiosis is thus unlikely to be caused by a high rate of dust deposition per se, and the deposition rate does not increase once x-ray changes of simple pneumoconiosis have developed.

34759 **APTIC NO. 57434**

MacFarland, H. N., C. E. Ulrich, A. Martin, A. Krumm, W. M. Busey, and Y. Alarie

CHRONIC EXPOSURE OF CYNAMOLGUS MONKEYS TO FLY ASH. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:313-327, 1971. 26 refs. (Sept. 14-23.)*

Groups of nine cynamolgus monkeys were exposed for 18 mo to 0.16 mg/cu m and 0.46 mg/cu m fly ash while a similar group was used as a control. The daily exposure was 24 hr, except for a 20 minute period twice a day to clean the chambers and an interruption in the exposure when animals were removed for physiological measurements. The fly ash was collected from four major power plants by sampling the post-precipitator effluent and was disseminated in the exposure chambers by Wright Dust Feed Generators. Measurements were made of growth and survival prior to and during the exposure, and pulmonary function tests were conducted to evaluate the mechanical properties of the lung, ventilation characteristics, distribution of inspired air, diffusion, and arterial blood gas tensions. Hematological and clinical biochemical measurements were performed. No significant changes in physiological parameters measured could be detected in the groups exposed to fly ash. Microscopic examination of the lung revealed the presence of fly ash in the alveolar macrophages, adjacent alveolar walls, and peribronchial lymph nodes in both groups of exposed animals. In the groups exposed to 0.46 mg/cu m, some of the macrophages had aggregated into small nodules in the alveolar walls and a minimal fibrotic response was present in a few of these nodules. (Author abstract modified)

34760 **APTIC NO. 57429**

Masse, R.

COMPARATIVE CYTOLOGICAL STUDY OF THE EFFECT OF INHALED PLUTONIUM AND SILICA ON THE BEHAVIOR OF THE ALVEOLAR MACROPHAGES. *(Etude cytologique comparee de l influence du plutonium et de la silica inhales sur le comportement du macrophage alveolaire). Text in French. British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London England, 1970, vol. 1:247-259, 1971. 17 refs. (Sept. 14-23.)*

The results of cytological observations and kinetic analysis of lung clearance in rats poisoned by plutonium and silica were compared to determine the parts played by the different parameters. Plutonium showed cytotoxic and cytostatic action and inhibited the bronchial excretion of macrophages. Silica showed cytotoxic action, enhanced cellular production, and inhibited the bronchial excretion of macrophages. Plutonium action appeared to be a threshold mechanism; below a limiting dose, cytological changes were compensated and did not result in any problem of excretion. The determining factor in the blockage of alveolar clearance seemed to be a problem of cellular mobilization or motility depending on the cell itself and its environment.

34761 **APTIC NO. 57451**

Mawdesley-Thomas, Lionel E., Peter Healey, and David H. Barry

EXPERIMENTAL BRONCHITIS IN ANIMALS DUE TO SULPHUR DIOXIDE AND CIGARETTE SMOKE. AN AUTOMATED QUANTITATIVE STUDY. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:509-526, 1971. 33 refs. (Sept. 14-23.)*

Increasing air pollution, both atmospheric and self-inflicted by tobacco smoking, has brought about a need for accurate quantitative bio-assays of irritation of the respiratory tract. Following preliminary anatomical studies of 12 animal species, it was decided that the rat and the lamb were the most useful experimental models for studying the effects of irritation on goblet cells, alveolar machrophages (rat), and bronchial and tracheal glands (lamb). Assessments of change occurring in the tissues were made with an image analyzing computer for the goblet cells and glands and a scanning microdensitometer for acid phosphatase activity in alveolar macrophages. Initial experiments using these techniques showed that it was possible to produce a dose-related response to sulfur dioxide and to separate increments as low as 25 ppm. These methods were successfully applied to various types of cigarette smoke in order to procuce an irritancy grading and thus assist in the evaluation of potentially less hazardous cigarettes. (Author abstract)

34762 **APTIC NO. 57455**

McCallum, R. I., M. J. Day, J. Underhill, and E. G. A. Aird

MEASUREMENT OF ANTIMONY OXIDE DUST IN HUMAN LUNGS IN VIVO BY X-RAY SPECTROPHOTOMETRY. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int., Symp., London, England, 1970, vol. 2:611-619, 1971. 17 refs. (Sept. 14-23.)*

A method for the detection and measurement of inhaled antimony trioxide dust retained in the lungs of antimony smelting and refining workers is described. Antimony pneumoconiosis appears to be symptomless and does not cause measurable respiratory disability. The measurment method depends on the absorption by the dust of monochromatic x-rays having two alternative wavelengths which lie on either side of the K critical wavelength of antimony. The antimony content of lungs is deduced from the differential attenuation of these two beams, using a scintillation counter as the detector. This method was used to screen 113 antimony process workers. Amounts of antimony up to about 11 mg/sq cm of chest area were observed. Antimony in the lungs was related to length of employment in the process and to radiographic category of the lungs in a statistical analysis. The assumption that the chest tissues were water-equivalent was confirmed. This method has a very limited application, since it is restricted to elements whose atomic numbers are above 40. For lower atomic number elements, the appropriate critical wavelengths are longer and unfortunately such x-rays are excessively attenuated in their passage through the chest. (Author abstract modified)

34763 **APTIC NO. 57466**

Minette, A.

THE ROLE OF PROFESSIONAL EXPOSURE TO DUST IN THE DEVELOPMENT OF CHRONIC BRONCHITIS IN COAL MINERS. *(Role de l empoussierage profes-*

sionnel dans la production des bronchites chroniques des mineurs de charbon). Text in French. British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 2:873-882, 1971. 34 refs. (Sept. 14-23.)

Epidemiological investigations were carried out in three environments: a locality in a coal-mining area, a special hospital for miners, and a colliery where dust was measured (concentration, quartz content, and number of days which the miners were exposed to it). A similar general prevalence of coughing and expectoration occurred in miners and non-miners of the same age and of the same social and ethnic characteristics in the same environment. Dyspnea was found more often in miners and even more frequently as an isolated initial symptom. The radiological picture did not appear to intervene until grade B. Signs of bronchitis were closely related to tobacco use. Age and the degree of smoking being the same, the number of years spent in the pit could increase the prevalence of bronchitis symptoms independently of the radiological picture. The third investigation did not show a clear association of this prevalence with the amount of dust in the atmosphere.

34764 APTIC NO. 57419

Muir, D. C. F., K. Sweetland, and R. G. Love

INHALED AEROSOL BOLUSES IN MAN. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:81-90, 1971. 13 refs. (Sept. 14-23.)*

The dispersion of a 200 ml bolus of 0.5 micron diameter particles in the lungs was studied in three normal subjects. The approximately uniform aerosols of di-2-ethyl hexyl sebacate were produced with a modified La Mer-Sinclair generator. No effect was observed when the expired flow rate was changed by a factor of three, and little change was evident with the bolus was inhaled at different lung volumes. The dispersion of the aerosol appeared to be related only to the volume depth to which it penetrated the lung. It cannot be assumed that this is a continuous process. The results were consistent with a mixing mechanism which is not solely determined by convective mixing during the flow of air, and no effect related to the mobility of the particles themselves could be demonstrated. (Author abstract modified)

34765 APTIC NO. 57415

Nadel, J. A. and S. W. Clarke

A NEW TECHNIQUE FOR STUDYING AIRWAY DEPOSITION, MORPHOLOGY AND MECHANISMS USING POWERED TANTALUM. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:43-47, 1971. (Sept. 14-23.)*

A new method for outlining the airways roentgenographically by insuffating finely powdered tantalum was developed. The technique was used to study: deposition of particles in the larynx with shallow panting, and at airway bifurcations with rapid deep breathing; impairment of mucociliary clearance by mucosal trauma, tumors, or lung reimplantation; the cough mechanism and its efficiency; regulation of small airways in vivo in conjunction with a fine focal spot x-ray tube; and anatomic abnormalities of airways in lung diseases.

34766 APTIC NO. 57459

Navratil, M.

PLEURAL CALCIFICATIONS DUE TO ASBESTOS EXPOSURE COMPARED WITH RELEVANT FINDINGS IN THE NON-EXPOSED POPULATION. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 2:695-703, 1971. 16 refs. (Sept. 14-23.)*

The prevalence of x-ray findings of pleural calcifications in workers and ex-workers of an asbestos factory located 40 km east of Prague amounted to 5.2% in employees working longer than 10 years in dusty environments. A large epidemiological study involving both exposed and nonexposed persons was begun after similar x-rays were found in inhabitants of a village near the plant. The pleural calcifications were often present in blood relatives of patients who either worked in the plant or were without any professional exposure (4.5%). Within a group of 112 relatives living near or far from the plant without asbestos exposure, relevant findings were positive in 3.6%. During a broad survey of the population in five villages 2-24 km from the plant, pleural findings were detected in 1.17%. Thus, asbestos exposure (chrysotile) was only one of the possible causes. Mineral metabolism and serum proteins with their fractions were studied. Calcium, phosphorus, and magnesium were not influenced in the serums of persons with pleural calcifications; only the activity of acid phosphatase was increased. The serum protein spectrum showed a significantly higher level of gamma globulin in persons with pleural calcifications compared with exposed workers without any findings or with control persons. The cause of pleural findings in the nonexposed population was not clear. (Author abstract modified)

34767 APTIC NO. 57422

Palmes, E. D., Robert M. Goldring, Chiu-sen Wang, and Bernard Altshuler

EFFECT OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE ON RATE OF DEPOSITION OF AEROSOLS IN THE LUNG DURING BREATH HOLDING. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:123-130, 1971. 9 refs. (Sept. 14-23.)*

Previous work demonstrated a change in deposition rate of aerosols in the human respiratory trace during breath holding in normal subjects at different degrees of lung inflation. In each subject the rate was lower when the lung volume at the time of breath holding was greater. This was attributed to the increased average size of the pulmonary spaces which necessitated longer time, on the average, for an aerosol particle to attain a wall. Because of destruction of alveolar walls in some patients with chronic obstructive pulmonary disease (COPD) and the resultant enlargement of air spaces, it was deemed advisable to extend the studies to patients with COPD. Groups of hospital patients were examined along with normal subjects. The diagnoses on all patients were based on routine spirometry, nitrogen washout, x-rays, and clinical appraisal. Normal subjects inhaling 1 l of triphenyl phosphate aerosol of 0.5-0.6 micron diameter showed half lives of 22.3-25.3 sec; both of those tested had normal N2 washout. None of the patients characterized as primarily bronchitic were able to perform the 1 1/2 l maneuver and all were necessarily run at smaller volumes. Two patients showed short half lives in spite of their small inhaled volumes. Three showed long half lives, but two of these had inhaled small volumes. The other bronchitic patient had abnormally increased half life. The persistence at 0 time was generally lower for this group than for the normals. All of the N2 washouts in this group were abnormal. Of the five classified as emphysematous but not bronchitic, all were able to accomplish the 1 1/2 l maneuver. The most interesting results were on two patients who showed half lives almost twice as great as the normals. The persistence at 0 time for this group was also lower than normal. Two of the three on whom N2 washout was measured, including one of the latter group, had normal values despite the large residual volume and total lung capacity. (Author abstract modified)

34768 APTIC NO. 57433

Pasquier, Ch., J. C. Lefebvre, and J. C. Ehrhart

BIOCHEMICAL ASPECTS OF THE EARLY ALVEOLAR RETENTION OF LIQUID AEROSOLS OF THE LANTHANIDE SERIES. *(Aspect biochimique de la retention alveolaire precoce ces aerosols liquides de terres* *rares). Text in French. British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:301-309, 1971. 23 refs. (Sept. 14-23.)*

A lipoprotein typical of the alveolar lining was isolated from endobronchial washing liquids obtained from rats and monkeys. This lipoprotein rich in glycolipids and free fatty acids had a lipidic composition widely different from the whole alveolar film. The part it played in the retention of unpolymerized lanthanum was demonstrated in vitro by polyacrylamide disc electrophoresis and in vivo by combined continued paper chromatography and electrophoresis. The stability of the lanthanum-lipoprotein complex was tested by DTPA, and its contribution in respiratory contamination is discussed.

34769 **APTIC NO. 57486**

Pratt, Philip C. and Kaye H. Kilburn

EXTENT OF PULMONARY PIGMENTATION AS AN INDICATOR OF PARTICULATE ENVIRONMENTAL AIR POLLUTION. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 2:661-670, 1971. 18 refs. (Sept. 14-23.)*

Lung specimens prepared from 510 autopsies of Durham, N. C. residents were studied by the point-counting procedure for quantification of pigment. Information on city or rural residence and smoking history was obtained from clinical records. A total of 227 cases, 81% of the normal lung specimens, could be classified as to smoking habits. Data obtained from the 79 normal lungs of nonsmokers and 125 lungs of moderate smokers revealed significant differences in pigmentation between the groups and among a number of subgroups. A synergistic effect was indicated from certain combinations of factors, such as smoking and city residence compared with smoking and country residence. Data from Columbus, Ohio, suggested a higher effective exposure rate there than in Durham; however, air quality data did not indicate higher particulate contamination in Columbus. The method for quantifying pigmentation is simple, convenient, and easily learned; it could be applied in the evaluation of general air pollution in other cities. (Author abstract modified)

34770 **APTIC NO. 57417**

Proctor, Donald F. and David L. Swift

THE NOSE -- A DEFENCE AGAINST THE ATMOSPHERIC ENVIRONMENT. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:59-70, 1971. 20 refs. (Sept. 14-23.)*

The nose is described as a defense against pollutant gases and particulates. The anatomical shape of the nasal air passages results in air flow characteristics which affect their function as filters for inhaled substances. Nasal mucociliary function, the flow of mucus from the paranasal sinuses, and the location of the adenoid tissue combine to complete the effectiveness of the nose in defense against the atmospheric environment. The nature of the nasal mucous membrane, the addition of the paranasal sinus mucus to the nasal mucous stream, and the character of air flow, both the higher linear velocity at the entrance and the lower velocity in the main passage are considered. (Author abstract modified)

34771 **APTIC NO. 57488**

Pujman, Vojtech and Slavjanka Prokopova

SOME TOXIC ALTERATIONS DUE TO THE APPLICATION OF DDT, ENDRIN, AND MELNIK POWER PLANT-EMITTED FLY ASH. *(Einige toxische Aenderungen nach der Applikation von DDT, Endrin und der Flugasche aus dem Kraftwerk Melnik). Text in German. TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 93-95. 2 refs. (Sept.)*

The separate and combined effects of orally administered DDT, endrin, and fly ash separated by the electrostatic precipitators in a thermal power plant on mice were studied. The oral LD50 values, determined for DDT, endrin, and fly ash are 8.2 mg/kg, 3.2 mg/kg, and 60 mg/kg. Fly ash, administered in 3 equal doses of 100 mg/kg on three consecutive days, increased the toxicity of endrin, but slightly reduced the toxicity of DDT. Measurements of the thiopental-induced sleep duration following the administration of combinations of fly ash with endrin and DDT revealed increased differences between the extreme values, without any statistically significant change in the mean value of the sleep duration, as compared to a control group.

34772 **APTIC NO. 57487**

Rae, S., D. D. Walker, and M. D. Attfield

CHRONIC BRONCHITIS AND DUST EXPOSURE IN BRITISH COAL MINERS. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 2:883-896, 1971. 23 refs. (Sept. 14-23.)*

The prevalence of bronchitis (persistent cough and phlegm) was measured in a group of 4122 face coal miners from 20 collieries. Questionnaires, x-rays, and industrial histories were used to establish indices of dust exposure. A statistically significant association was found between increasing exposure to airborne dust and increasing prevalence of bronchitis in the 25-34 and 35-44 year old groups. Smoking and the presence of pneumoconiosis were associated in all age groups with an increased prevalence of bronchitis. (Author abstract modified)

34773 **APTIC NO. 57441**

Rasche, B.

REACTIONS OF ALVEOLAR MACROPHAGES DURING SHORT-TERM DUST EXPOSURE WITH AND WITHOUT VARIOUS PHARMACOLOGICAL SUBSTANCES (GLUCOCORTICOIDS AND PVN-OXIDE). *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:391-401, 1971. 17 refs. (Sept. 14-23.)*

Cellular alveolar clearance was studied by having rats inhale 40 mg/cu m of colored dust for 5 hr. Even after 6 mo of a single dust exposure, marked phagocytes remained in the alveolar space or passed through it. Rats were studied for more than 20 mo to determine whether cellular elimination by alveolar macrophages is dependent on the age of the animals and whether the number of macrophages available for phagocytosis and their phagocytosic capacity are changed with increasing age. Phagocytic activity was age dependent, with a maximum between the 4th and 10th month and a lower level persisting from the 12th to the 18th month of age. Evacuation of dust-laden cells was not affected by age. Cellular lung clearance mechanisms could be influenced by pharmacological agents, such as glucocorticoids which may be used in the therapy of chronic bronchitis. After a prolonged application of prednisolone in rats, followed by 5 hr of dust irritation, the number of cells and the phagocytic rate decreased gradually. The phagocytic index increased to about the same extent, i.e., the available macrophages could digest the larger amount of dust. Polyvinylpyridine-N-oxide (PVNO) protected the cell membranes during dust uptake, particularly by protecting the lysosome matrix. The substance also engaged in the cellular alveolar clearance, following intraveneous injection of rats with PVNO and after inhalation of PVNO.

34774 **APTIC NO. 57472**

Reeves, Andrew L., Robert H. Swanborg, Elizabeth K. Busby, and Neil D. Krivanek

THE ROLE OF IMMUNOLOGIC REACTIONS IN PULMONARY BERYLLIOSIS. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 2:599-608, 1971. 28 refs. (Sept. 14-23.)*

To test the proposition that pulmonary berylliosis is linked to hypersensitivity and that the pathogenesis depends on immunological reactions which could be retarded or prevented by treatment, a colony of guinea pigs was divided into three groups. In one group, a state of hypersensitivity was produced by intradermal injections of beryllium sulfate. The second group received low levels of BeSO4 in the drinking water to produce a state of immunosuppression. The third group was untreated. All three groups were than subjected to the inhalation of beryllium aerosol at selected atmospheric concentrations, and the histopathologic response determined at periodic sacrifices. Distinctly alleviated tissue response occurred in the lungs of intradermally treated animals, most of which were in a state of cutaneous sensitivity. The incidence of response to skin testing in the control and orally treated groups was 10-20%; the pulmonary reaction to Be inhalation in these groups did not differ significantly. Beryllium-injected animals had substantially lower mortality rates and lower average lung weight gain rates than the other two groups. They also showed a larger decrement of neutrophilia. This suggests that the induction of cutaneous sensitivity to Be produces a protective effect against the development of pulmonary berylliosis. (Author abstract modified)

34775 **APTIC NO. 57447**

Robock, K. and W. Klosterkoetter

THE CYTOTOXIC ACTION AND THE SEMICONDUCTOR PROPERTIES OF MINE DUSTS. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London England, 1970, vol. 1:453-464, 1971. 18 refs. (Sept. 14-23.)*

Thirty-nine samples of mine dust were collected in 16 collieries of the Ruhr District and five samples of mine dust in three collieries of the Saar District by the BAT I Fine Dust Filter Device. The samples collected on the membrane filter in the BAT I device showed an upper particle size of 7 micron, corresponding to the size selection curve of the device. Dust was separated into micro-sieved fine dust by screening through a micro-sieve. The fine dust filter samples were a maximum of 1 micron in diameter. Quartz content of the dust filter samples varied from 0.2 to 18.6%. The ash content was 5-81.2%; that of the micro- sieved samples was 10.3-84.6%. A quartz-free dust sample was prepared from adjacent rock with an upper particle size of 5 micron. Then the cytotoxic action of the mine dusts and the quartz-free clayey shale were determined on peritoneal macrophages from guinea pigs. A dust concentration of 0.6 mg/400,000 cells was used. No clear relationship was found between the cytotoxic behavior of the samples and their quartz and ash content. Mine dusts with only 0.2% quartz and the quartz-free samples had a strong cytotoxic effect. Measurements of the semi-conductor properties by means of luminescence indicated that the quartzes in the samples had very different electron structures, that the association with accompanying minerals and types of coals also had a certain influence and that the cytotoxic effect of the clayey shale showing a strong lymphatic transport in the animal experiment could be explained by its electron structure.

34776 **APTIC NO. 57448**

Robock, K. and W. Klosterkoetter

BIOLOGICAL ACTION OF DIFFERENT ASBESTOS DUSTS WITH SPECIAL RESPECT TO FIBRE LENGTH AND SEMICONDUCTOR PROPERTIES. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:465-475, 1971. 19 refs. (Sept. 14-23.)*

The cytotoxic effect of five UICC standard reference asbestos samples were studied by the TTC method, the nigrosin method, and by polarographic determination of the oxygen consumption of cells. The influence of dry grinding on the structure of the samples was analyzed by infrared spectroscopy, and the influence on the cytotoxic effect was studied. Measurements of luminescence were made to determine the activation energies of the electron traps of the samples. Indications were found on the cytotoxicity of the asbestos dusts and on a considerable structural influence by grinding. Chrysotile had the highest cytotoxic effect and crocidolite had a weaker one. But the shape of the fibers must be taken into account as an important factor on toxicity. The thin and straight crocidolite fibers can penetrate into the pleura in a certain quantity during inhalation, but not the chrysotile with its curved fibers. The curved chrysotile is completely arrested and deposited high in the respiratory tract and does not penetrate the pleura. This explains the observed relation between exposure to crocidolite and tumors of the pleura. When applying asbestos dusts by pleural injection in vivo, the influence of the shape of the fibers is eliminated.

34777 **APTIC NO. 57465**

Roschin, A. V.

INDUSTRIAL AEROSOLS OF RARE METALS AND THEIR HYGIENIC SIGNIFICANCE. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 2:811-817, 1971. 3 refs. (Sept. 14-23.)*

The production and processing of rare metals and their compounds causes the emission of disintegration and condensation aerosols. Both kinds of aerosols should be referred to as highly dispersed industrial aerosols. Condensation aerosols have a higher degree of dispersity, but may quickly change due to flocculation of fine particles and formation of conglomerates. The degree of toxicity of the condensation aerosols is higher than that of the disintegration ones of the same metals. Aerosols of refractory metals such as titanium, tungsten, rhenium, zirconium, tantalum, niobium, and lanthanoids do not induce acute or chronic poisoning at the actual site of absorption, nor exert any general toxic action. They cause mildly manifested changes in the respiratory organs, which can lead to disorganization of the collagen complex, derangement of tissue immunity, and so on. Aerosols of other rare metals (beryllium, cadmium, vanadium, selenium, tellurium, thallium, molybdenum, alkali metals) are capable of producing well-marked chronic inflammatory changes in the pulmonary tissue and respiratory tract mucosa, as well as exercising general toxic action. Alterations in the respiratory organs have distinctive features of their own, depending on the kind of metal and aerosol properties. General expressions of the toxic action and profound differences in the nature and mechanisms of toxic action both exist. (Author abstract modified)

34778 **APTIC NO. 57453**

Rylander, Ragnar, Maj Ohrstrom, Per Ake Hellstrom, and Richard Bergstrom

SO2 AND PARTICLES -- SYNERGISTIC EFFECTS ON GUINEA-PIG LUNGS. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:535-541, 1971. 14 refs. (Sept. 14-23.)*

The pulmonary clearance of viable nonpathogenic bacteria (E. coli) and inert particles (radioactive, killed E. coli) was determined in inhalation experiments where guinea pigs were exposed to manganese dioxide, sulfur dioxide, and a combination of SO2 and MnO2. The animals were exposed for 6 hr daily, 5 days/wk for 4 wk. Ninety percent of the particles in the aerosol were less than 0.5 micron. In another experiment the addition of SO2 to MnO2 on a filter lowered the pH from 4.3 to 3.3. The ability of the lung to clear inert particles was decreased in animals exposed to MnO2 plus SO2 compared to control animals exposed to either of the two agents alone. A decreased clearance of viable bacteria was noted in the same group. The results indicate the importance of synergistic effects in the evaluation of airborne pollutants and point to the possible influence of pH of particulate matter for the development of biological effects. (Author abstract modified)

34779 **APTIC NO. 57444**

Sakabe, H., K. Koshi, and H. Hayashi

ON THE CELL TOXICITY OF MINERAL DUSTS.

British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:423-435, 1971. 20 refs. (Sept. 14-23.)

Cytotoxicity and hemolysis were studied in 22 silicate dusts and in quartz dust. The effects of different silicate dusts on acid phosphatase activation, lactic acid production, and hemolysis in rat cells were similar, but quartz had a different effect on the macrophages and red blood cells. The biological activity of the surface seemed to be different between silicate and quartz. Changes of cytotoxicity and hemolytic action of 12 silicate dusts and quartz dust after heat treatment were studied. Many minerals lost their cytotoxicity and hemolytic action by heat treatment, but serpentine minerals heated around 650 C showed high biological activity. Quartz lost its cytotoxicity by heating over about 500 C, and these particles absorbed methylene blue though quartz treated under about 500 C did not. The role of serum in cytotoxicity of mineral dusts was also studied. Chrysotile heated to 650 or 750 C was harmful to rats, since it stayed in a naked state in the body fluids. Alkali-treated quartz covered with serum had less cytotoxic activity than naked quartz. Biologically active properties of dust surface in the naked state and protein adsorption of mineral dusts are also mentioned. (Author abstract modified)

34780 **APTIC NO. 57442**

Schiller, Erich

EXPERIMENTAL PATHOLOGY AND PHARMACOLOGY OF DUST EXPOSURE: AN ELECTRON MICROSCOPIC STUDY.

British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:403-414, 1971. 49 refs. (Sept. 14-23.)

The alveolar macrophages of the rat are situated beneath the epithelium which is often only 20 nm thick. The great alveolar cells are rich in organelles, especially in concentrically lamellated spheres and mitochondria. Under the influence of thyroxine, vacuoles containing osmiophilic lamellae are protruded at their free surfaces. Orciprenaline activates the GOLGI apparatus and the ergastoplasmic reticulum. Pilocarpine induces large autophagous vacuoles. Female rats weighing about 250 g were dusted with powdered aluminum and magnetite. Over a period of 5 min, a puff was blown every 5 sec into a closed experimental chamber in which the rats remained for 15 min. The lungs were fixed under intact blood circulation in an inflated state, and tissue specimens were examined by electron microscopy. Alveolar macrophages of the rats contained numerous cytoplasmic inclusions with a moderately dense matrix bounded by a unit membrane. Very electron-dense bizarre structures were formed; they increased by consuming their matrix and finally occupied the entire space limited by the membrane. Poly-2-vinylpyridine-N- oxide inhaled in a micronized solid state was stored within lysosomes. Bronchiolar studies showed a vesicular component in the outer zone of the axonema, the transformation of ciliated cells in club cells, and the formation of a branched system of membranous tubes after phenylephrine inhalation. (Author summary modified)

34781 **APTIC NO. 57446**

Schlipkoeter, H.-W., W. Hilscher, F. Pott, and E. G. Beck

INVESTIGATIONS ON THE AETIOLOGY OF COAL WORKERS PNEUMOCONIOSIS WITH THE USE OF PVN-OXIDE.

British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:379-390, 1971. 12 refs. (Sept. 14-23.)

Rats were exposed to mixed dusts, natural mine dust, and dust isolated from human lungs. The mixed dust consisted of 48 mg of titanium dioxide and 2 mg of quartz. The inhibition of the action of quartz by other admixed dusts was a short-term effect. This inhibition depended upon a close contact of the accompanying dusts with the quartz. The activity reappeared, after a time, due to separation of the dusts. These reactions were particularly noticeable in lymph nodes examined histologically. Dusts isolated from human lungs and used in animal experiments showed typical quartz reactions significantly earlier than mine dusts. These reactions were prevented by injecting the animals with polyvinylpyridine-N-oxide (PVNO), which indicated that they were due to quartz. Mine dusts showed an acute toxicity in vivo and in vitro, which probably had no relation to any eventual fibrogenic action. (Author abstract modified)

34782 **APTIC NO. 57454**

Shevchenko, A. M.

THE ROLE OF SOME PHYSICAL AND CHEMICAL PROPERTIES OF MINE DUST IN THE DEVELOPMENT OF PNEUMOCONIOSIS.

British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:561-570, 1971. 4 refs. (Sept. 14-23.)

During a study of mine dust and its effect on the development of pneumoconiosis, 92-100% of the dust particles entering the air of underground and surface mines carried electrostatic charges. Some particles carried one to five elementary electrostatic charges, while others carried up to 2000 or more. In experimental animals (rats), electric charges did not influence retention of quartz dust particles in the deep respiratory tract. The mean content of silica in animals which inhaled bipolar (negative) charged dust as 11.18 + or 0.5 mg/lung, and in animals inhaling electro-neutral dust, 11.19 + or - 0.8 mg/lung. Inhalation of all kinds of dust was followed by the development of silicotic changes whose severity depended upon the electric charge on the particles. Negatively charged dust caused more fibrosis development than positively charged dust during a short exposure; a prolonged experiment showed a decrease in the differences found in the shorter experiment. The mean content of collagen in the lungs of animals exposed to bipolar charged dust was 66.48 + or 1.6 mg/lung; in animals inhaling electro-neutral dust it was 47.36 + or 1.6 mg/lung. Control group animals (without dust exposure) had 37.71 + or 1.9 mg/lung of collagenous proteins. Silicotic nodules in lung parenchyma increased and more necrosis of dust phagocytes occurred during dusting with electro-charged dust. During blasting operations, large amounts of carbon monoxide and nitric oxides form which are adsorbed by the dust. The electric charges on the particle surfaces increase the ability to adsorb toxic gases. Experimental investigations were used to determine the dependence of explosion-gases adsorption on temperature, gas concentration, and water vapor. Then rats were exposed to dusts with adsorbed CO and NOx to determine their fibrogenicity. Silicosis occurred with plain quartz dust and dust with CO and NOx. The adsorption of CO favored dust retention and increased fibrogenicity. Iron oxide dust was weakly fibrogenous. No intensification of fibrogenicity occurred with iron ore dust with adsorbed CO. Dust with adsorbed NOx had lower aggressive action than clean dust.

34783 **APTIC NO. 57409**

Spaleny, J. and R. Reisenauer

GOITRE INCIDENCE AND DEVELOPMENT AMONG THE INHABITANTS OF AN INDUSTRIAL AREA POLLUTED BY ATMOSPHERICAL SO2. *(Vyskyt strumy a jeho vyvoj u obyvatelstva prumyslove oblasti znecistene atmosferickym SO2). TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 96-106. 33 refs. (Sept.)*

Comparisons of goiter incidence for the periods 1947-1948 and 1967-1969 were made between the area of the North Bohemian brown-coal basin, an area polluted by sulfur dioxide and the Central Bohemian Region which served as a control area. A total of 2743 women, divided into two age groups (11-20 yr and 21-50 yr) were examined from the polluted area. Frequency of goiter in the polluted region was markedly dependent on the number of inhabitants in a given village, and 10 out of 11 investigated villages with populations up to 2000 whowed higher averages of goiter incidence than the control area as a whole. Increased frequency of goiter in the smaller villages averaged 2% for women between the ages of 11-20 and 6.7% for those between 21 and 50 yr. Incidence of goiter in towns with over 2000 inhabitants was significantly lower than in the control area. Incidence of goiter for the smaller villages (less than 2000 population) decreased for the older age group between the first and second investigations, perhaps reflecting preventative measures (e.g., iodized salt) initiated in 1947 within the territory of the Czech Republic.

34784 **APTIC NO. 57425**

Spritzer, Albert A., Joseph A. Watson, and Judith A. Auld

CLEARANCE RATES DETERMINANTS: PARAMETERS INFLUENCING CLEARANCE RATES OF PARTICLES IN THE UPPER RESPIRATORY TRACT. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:149-155, 1971. 9 refs. (Sept. 14-23.)*

A new method for obtaining the effective linear particle transport velocity of the mucociliary escalator of the trachea of the rat is described. Clearance rates of particles from the trachea into the oropharynx were determined by the effective linear particle transport velocity of the mucociliary escalator of the trachea and by the linear density distribution of particles along the trachea. This latter distribution was unform during slower phases of pulmonary clearance. The linear particle transport velocity was obtained by dividing the particle clearance rate by the density distribution parameter. The mean linear particle transport velocity obtained by this method with 20 rats exposed to lead chromate particles by inhalation was 2.01 + or 0.26 mm/min. Homeostatic mechanisms which maintain the clearance rates of particles from the upper respiratory tract are discussed in terms of these concepts. (Author abstract modified)

34785 **APTIC NO. 57414**

Sudlow, M. F., D. E. Olson, and R. C. Schroter

FLUID MECHANICS OF BRONCHIAL AIR-FLOW. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:1931, 1971. 13 refs. (Sept. 14-23.)*

Flow characteristics in large scale models of typical junctions of the human bronchial tree and in casts of the trachea and first few generations of bronchi were investigated. Steady inspiratory flows were investigated at flow rates appropriate to man at rest, with blunt or parabolic velocity profiles entering the cast or model. In the models, secondary motions were observed at all flow rates and, depending upon local geometry in the region of the junction, flow separation and reversed flow were observed. Velocity profiles were high asymmetric downstream of the junction with peak velocities on the inner wall of the daughter tube. Similar velocity profiles were found in similar geometric situations in the casts. In the bronchial tree flow patterns are complex and it is unreasonable to assume parabolic flow simply on the basis of calculated Reynolds numbers. (Author abstract modified)

34786 **APTIC NO. 57416**

Timbrell, V. and J. W. Skidmore

THE EFFECT OF SHAPE ON PARTICLE PENETRATION AND RETENTION IN ANIMAL LUNGS. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:49-57, 1971. 6 refs. (Sept. 14-23.)*

Large particles of noncompact shape can be of sufficiently small aerodynamic size to permit penetration into pulmonary air spaces. An inhalation experiment on rats was performed to indicate how large dimensions may affect the deposition and retention of the particles in the lungs and whether the size-selecting gravimetric sampling instruments developed for use with particles of compact shape are suitable when the particles are of other shapes. Particles of large dimensions in one, two, or three aspects were produced by fusing airborne glass fibers in various configurations. The experimental penetration curve of the horizontal elutriator for spherical particles was in good agreement with the theoretical curve. The retention curve of the rat lungs for spherical glass particles resembled the penetration curve of a horizontal elutriator with 50% penetration of glass spheres of 2 micron diameter. In the size range of interest, fiber length was a minor factor in the fiber penetration of the elutriator, but was a major factor in retention of fibers in rat lungs. This indicates that the horizontal elutriator was not complete as a size selecting system for use with particles of elongated shape. There was a change of slope in the lung retention curve at about 20 micron fiber length. A possible explanation is a lower efficiency of the clearance processes for longer fibers. There was no clear difference indicated between the retention rate of straight fibers, curved fibers, and fiber aggregates in the rat lungs. The influence of fiber length was so great that evidence on the effect of the fiber shape and secondary dimensions requires a dust cloud containing higher proportions of long and more-curved fibers than used in the present experiment. (Author summary modified)

34787 **APTIC NO. 57436**

Weller, W.

THE RELATIONSHIP BETWEEN DURATION OF DUST INHALATION OF A COAL- QUARTZ MIXTURE AND DUST RETENTION, LUND FUNCTION AND PATHOLOGY ON RATS. *British Occupational Hygiene Society, London (England), Inhaled Particles III, Proc. Int. Symp., London, England, 1970, vol. 1:337-345, 1971. 21 refs. (Sept. 14-23.)*

Rats were exposed to long-term concentrations of coal-quartz dust (60% coal, 40% quartz) (45 mg/cu m less than 10 micron) for 5 hr/day, 5 days/wk, for 18 mo. Some of the animals were retained for a further 4 mo without exposure. The coal, ash, and quartz contents of the lungs and the pulmonary lymph nodes were determined after 9, 18, and 22 mo. Measurements were made of the minute volume, oxygen consumption, intrapleural pressure, lung volume compliance, and pressures within the right ventricle. Histological preparations of the lungs and lymph nodules were also made. The histological investigation showed that the lung changes were not very marked, despite the high quartz content of the lung dust. Though numerous mixed dust granulomata were found in the lungs, the respiratory and circulatory functions were only slightly affected. These findings were in agreement with recent investigations on man. The dust content of the lungs and pulmonary lymph nodes indicated that dust deposition within the lungs occurred linearly with exposure time. Dust elimination from the lung after exposure was not very marked. The lympho-tropism of quartz was not extensive during inhalation, but became evident 4 mo after the end of dust inhalation. (Author summary)

1970

34788 **APTIC NO. 57116**

Henke, G.

CADMIUM DETERMINATION IN THE LIVER AND KIDNEYS OF CHILDREN AND JUVENILES BY MEANS OF NEUTRON ACTIVATION ANALYSIS. *(Cadmium- Bestimmungen in Leber und Nieren von Kindern und Jugendlichen durch Neutronaktivierungsanalyse). Arch. Toxikol. (Berlin), vol. 26: 8-16, 1970. 21 refs. Translated from German, 13p.*

The determination of cadmium in the liver and kidneys of children and juveniles by means of neutron activation analysis was investigated. Cadmium concentrations of 4.10 to the -3rd power to 8.8 and less than 2.10 to the -2nd power to 1.2 microgram/g fresh weight of tissue were found in kidney and liver respectively of 41 children and juveniles. Cadmium was detectable even in newborns. The Cd concentration increased 200-fold during the first 3 yr of life. The cause and meaning of this increase are not yet clear. (Author abstract modified)

34789 **APTIC NO. 57237**

Peacock, Peter B.

THE ASSOCIATION OF SERUM CADMIUM VALUES WITH INDICES OF CARDIOVASCULAR AND OTHER DISEASE AND CERTAIN ENVIRONMENTAL FACTORS. (FINAL REPORT). *Alabama Univ., Birmingham, Dept. of Public Health and Epidemiology Dept. of Health, Education, and Welfare Contract PH 86-67-39, 51p., May 18, 1970. 16 refs.*

A random sample of 127 residents of Birmingham, Alabama (ages 50-69) were given a detailed questionnaire on their health status supplemented by a complete medical examination and a variety of laboratory tests, including serum cadmium estimation, in an effort to obtain a measure of cadmium exposure and to relate this with disease experience and certain environmental and personal factors. The mean serum cadmium level found in the sample was 1.337 micrograms/100 ml, and the coefficient of variation for the pooled serum control was 13.5%. A highly significant relationship was found between place-of-residence and serum cadmium levels, with the highest levels occurring among those exposed to cadmium as an air pollutant which was presumably derived from the industrial steel complex in Birmingham. There was also a suggestive slight increase in serum cadmium levels among active cigarette smokers, occurring as a short-term effect. A relationship with vertigo was statistically significant, and one with reduced vital capacity was of borderline significance. No dietary or personal factor was positively correlated at a statistically significant level with serum cadmium levels. (Author summary modified)

1969

34790 **APTIC NO. 57222**

Ecanow, Bernard, Reuben C. Balagot, and Valerie Bandelin

EFFECT OF SUSPENDED PARTICLES ON THE GAS-ABSORBING ABILITY OF LUNG SURFACTANTS. *Am. Rev. Respirat. Disease, 99(1):106-108, Jan. 1969. 11 refs.*

Surfactant material was obtained by injecting normal saline into the lungs of dogs and extracting the foamy solution resulting from ventilation. Powdered sulfamerazine was suspended in concentrated and dilute solutions of lung surfactant and in solutions containing no surfactant, and halothane gas was passed through. The amount of halothane in the lung solutions was measured by gas chromatography. Concentrated surfactant solutions without powder rapidly absorbed the amount of gas. Concentrated surfactant solutions containing powder absorbed the gas to a lesser extent. The rate and extent of gas absorption in both cases indicated the presence of micelles in the surface. A decrease in surfactant concentration lessened the amount of gas absorbed, and fewer micelles were present. The addition of powder to the dilute surfactant solution appeared to result in the concentration of surfactant upon the interface. Evidence for this was the increased absorbing ability of the suspension compared to the solution. Samples with an aqueous surface containing only trace amounts of surfactant absorbed little or no gas.

34791 **APTIC NO. 57555**

Holland, Robert A. B.

RATE AT WHICH CO REPLACES O2 FROM O2HB IN RED CELLS OF DIFFERENT SPECIES. *Resp. Physiol. (Amsterdam), 7(1):43-63, June 1969. 26 refs.*

The rate at which carbon monoxide replaces oxygen from oxyhemoglobin in red blood cells and in solution was measured for different species. Red cells studied were those of the human adult and newborn, rabbit, dog, cat, horse, goat, and toad. At 37 C, the cell reaction rate was more affected by the rate in solution than by the size of the cells. At lower temperatures, the cell and solution rates were closer together, and at 25 C, the replacement reaction was as fast in the large cells of the toad as is in some mammalian cells. The energy of activation (E) of the replacement reaction in solution was approximately 20 kcal/mole for the three hemoglobins in which it was measured. For the reaction in red cells, E was in the range predicted from E in solution. The rates of the replacement reaction were applied to measurements of the diffusing capacity of the pulmonary membrane and the pulmonary capillary blood volume by the method of Roughton and Forster. The pulmonary capillary blood volume can be measured without knowledge of the cell reaction rate, provided that the solution rate at low CO tensions is known. (Author abstract modified)

1968

34792 **APTIC NO. 57182**

Videbaek, Jorgen

RESPIRATORY ALLERGY AND CLIMATIC CONDITIONS. II. OWN INVESTIGATIONS. *Acta Allergol., 23(6):455-474, Dec. 1968. 44 refs.*

Experiments were performed to determine whether it is possible to influence the content of large airborne allergens in the air by changing the electric climate and relative humidity. Thus, the velocity of fall for Pinus Montana pollen was examined in various combinations of naturally occurring electric climate and relative humidity. A negative field may keep a small particle with positive specific charge suspended. Small atmospheric ions around this kind of particle would either be attracted or repulsed by the charge of the particle, by which its specific charge is affected, influencing its ability to be suspended in the electric field. However, no reduced fall velocity, and thus no increased air concentration was seen in the pollen, and therefore electric fields are of no practical importance to the allergic patient.

1967

34793 **APTIC NO. 57249**

Boren, Hollis G.

SEQUENCE OF EXPOSURE TO ENVIRONMENT AGENTS AS A DETERMINANT OF PULMONARY INJURY. *Aspen Emphysema Conference, 10th, 1967, p. 395-410, June 1967. 6 refs.*

This study was undertaken to determine whether inhalation exposure to agents in sequence might elicit morphological changes in the lung which could not be found when an agent acted alone or at the same time as another agent. Guinea pigs were exposed either to charcoal dust followed by nitrogen dioxide, or to NO2 followed by charcoal. Charcoal was inhaled in concentrations of 300-700 ppm/cu ft; NO2 gas concentration was 20-75 ppm. Exposure to NO2 alone showed pulmonary edema, congestion, and some hemorrhage. Exposure to carbon alone showed carbon accumulation within the alveolar macrophages, in conducting airways, and in perivascular lymphatics. Carbon inhalation three times weekly followed by one NO2 exposure in 1 week showed minimal destruction of alveolar walls, but after a period of 12 weeks of carbon-NO2 exposure, lung destruction was apparent. Exposure to NO2 followed by twice-weekly exposure to carbon gave no evidence of lung destruction, indicating that the sequence of exposure of these two agents may determine the morphological response. However, exposure to NO2 may suppress phagocytosis, leaving the lung more susceptible to damage by other types of environmental agents.

1953

34794 **APTIC NO. 57251**

Peart, Arthur F. and Gordon H. Josie

PLANNING A STUDY TO DETERMINE THE EFFECTS OF AIR POLLUTION ON HEALTH. *Arch. Ind. Hyg. Occupational Med., vol. 7:326-338, 1953. 11 refs. (Presented at the American Association for the Advancement of Science, Annual Meeting, 119th, St. Louis, Mo., Dec. 29, 1952.)*

The increasing number of smog incidents and accidental fumigations in the atmosphere have indicated a need for a comprehensive health study in the field of air pollution. A review of the Detroit River air pollution investigation was presented giving some of the environmental findings. The objectives of the investigation were to determine the sources, nature, and amounts of various pollutants in the atmosphere and the effect of meteorological conditions on such pollution. The effect of contaminants on health and procedures for controlling such pollution were also studied. To determine the effects of pollution on health, mortality and morbidity studies were conducted. Spectrographic analysis was used to indicate the types and amounts of pollution in the area. The basic research principle of trial and evaluation was used to test study methods and techniques in searching for a reliable health index to be associated with air pollution.

1950

34795 **APTIC NO. 57258**

Barbe, Leonce

ELECTRONIC DETECTION OF VOLATILE SOLVENTS IN THE PAINT AND LACQUER INDUSTRY. *(La detection electronique des valeurs de solvants volatils dans l industrie des peintures et vernis). Text in French. Peintures, Pigments, Vernis, 26(1):19-22, Jan. 1950.*

Toxic effects of various volatile solvents used in the paint and lacquer industry, and an instrument for the electronic detection of halogens, carbon disulfide, and ammonia in the workplace atmosphere in the paint and lacquer industry are described. The device includes a pyrolysis chamber, a photoelectric cell, and a microammeter. The sensitivity for trichloroethylene lies at 0.05 g/cu m. The instrument releases acoustic or light signals whenever specific concentration limits are exceeded. Among the solvents used in paint and lacquer manufacturing processes, benzene features toxic properties, and a leucotoxic effect. Toluene and xylene excell by even higher toxicity. Fatigue, vertigo, respiratory troubles, cough, and conjunctivitis follow acute or chronic inhalation of petroleum ether. Turpentine oil irritates the mucosa and epidermis, paralyzes the central nervous system, the heart, and the respiratory system. Narcosis, degeneration of the ganglions, polyneuritis, partial paralysis of the limbs, apathy, hallucination, reduced visual acuity, and dementia may be caused by carbon disulfide. The maximum allowable workplace concentrations of carbon disulfide, benzene, toluene, xylene, chloroform, methanol, methyl chloride, dichloroethylene, ether, petroleum ether, tetrachloroethane, trichloroethylene, acetone, and ethanol are 0.01, 0.02, 0.1, 0.2, 0.2, 0.5, 0.5, 0.5, 0.5, 1, 1, 1, 1, and 2 mg/l, respectively.

1945

34796 **APTIC NO. 57390**

Amdur, Mary O., L. C. Norris, and G. F. Heuser

THE NEED FOR MANGANESE IN BONE DEVELOPMENT BY THE RAT. *Proc. Soc. Exp. Biol. Med., vol. 59:254-255, 1945. 7 refs.*

Studies were undertaken to determine if evidence could be obtained of abnormal bone formation in rats in which gains in weight of pairmates were equalized. At 4 weeks the rats were paired and placed on experimental diets. The feed consumption of the rats on the high-Mn diet was limited so that it gained in weight at the same rate as its pairmate. Rats on the low-Mn diet were fed ad libitum. The bones of rats on a high-Mn diet were longer than those on a low-Mn diet. The density of the fresh bones of manganese-deficient rats was lower than that of their pairmates. A possible explanation is that the bones of the manganese deficient rats contained more fat and less water than those of normal rats. The breaking strength of the bones was much less than those of the controls. The difference may be due to the lower density of the bones, structural changes in the matrix, or changes in the crystal structure of the bones salts of the deficient rats. There was less phosphatase activity in the fresh bones of the deficient rats. There was no difference between the two groups in percentage of ash, calcium, phosphorus, and magnesium in the fat-free dry bones.

EFFECTS-PLANTS AND LIVESTOCK

1973

34797 **APTIC NO. 57746**

Bleasdale, J. K. A.

EFFECTS OF COAL-SMOKE POLLUTION GASES ON THE GROWTH OF RYEGRASS (LOLIUM PERENNE L.). *Environ. Pollut., 5(4):275-285, Dec. 1973. 9 refs.*

Plants of S23 ryegrass were grown in soil of low fertility and in soil improved with fertilizers and exposed to sulfur dioxide, water-scrubbed air which removed 98-100% of the SO2, and clean air. Plants grown in polluted air weighed 16-57% less than plants grown in similar air that had been scrubbed. Plants which were treated for part of each day with polluted air were heavier and had more leaves and tillers than plants grown continuously in either scrubbed or polluted air. In none of the experiments were abnormal leaf lesions observed, although leaf senescence was accelerated by polluted air. The SO2 in polluted air was responsible for the observed effects; the enhancement of growth during intermittent treatment with polluted air was accounted for by postulating that the balance of partially oxidized and reduced sulfur radicals, known to control cell division, was affected. Since this mechanism of control is common to both plants and animals, it is possible that SO2 could affect animal health by interfering with cell division. (Author abstract modified)

34798 **APTIC NO. 57716**

Holub, Zdenek and Olga Kontrisova

PHYTOINDICATION OF AIR POLLUTION BY FLUORINE IMMISSIONS. *(Phytoindikation der Luftverunreinigung durch fluorimmissionen). Text in German. Biologia, 28(10):827-836, 1973. 24 refs.*

A method of leaf analysis for studying the content of toxic substances in plant leaves is described. It can be used to measure areas polluted with fluorine. Analyses of naturally occurring plant species are suitable in regions with higher fluorine content in the atmosphere. Lower concentrations of fluorine in the air are indicated in a more sensible way by the fluorine content of lichens or of plants that have been cultivated in more or less standardized conditions.

34799 **APTIC NO. 57309**

Rentschler, Ingeborg

THE SIGNIFICANCE OF THE WAX STRUCTURE ON LEAVES CONCERNING THE SUSCEPTIBILITY OF THE PLANTS TO AIR POLLUTANTS. *(Die Bedeutung der Wachsstruktur auf den Blaettern fuer die Empfindlichkeit der Pflanzen gegenueber Luftverunreinigungen). Text in German. Proc. Int. Clean Air Congr., 3rd, Duesseldorf, West Germany, 1973, p. A139-A142. 12 refs.*

Studies on the relationships between the presence and structure of wax coating on leaves and plant susceptibility to air pollutants are reviewed. Plants with wettable leaves without wax coating are more susceptible to air pollutants than such with wax-coated leaves. Leaves without wax coating adsorb particulate matter readily, which very often leads to the stomata becoming clogged. The adsorbed pollutants can be rarely washed off. Young leaves with amorphous wax coats are most resistant to air pollutants. Particulate matter settled on leaves with a hydrophobic wax coat is readily wahsed off by rain. The leaves may lose part or all of their wax coats during the vegetation period. Plants with wax-coated leaves on which the wax coat does not deteriorate during the vegetation period, and also covers the stomata are most resistant to air pollution. Since the development and the nature of the wax coating is dependent on both the humidity and the air temperature, the local climatic conditions influence the susceptibility of the plants to air pollution.

34800 **APTIC NO. 57526**

Serdy, Frank Stephen

THE EFFECT OF COMPETITION, HERBICIDES, AND ETHYLENE ON THE GERMINATION, GROWTH, AND DEVELOPMENT OF FALL PANICUM (PANICUM DICHOTOMIFLORUM MICHX). *Pennsylvania State Univ., Dept. of Agronomy, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1973, 87p. 44 refs.*

The effects of competition, herbicides, and ethylene on the germination, growth, and development of fall panicum were investigated in germinator greenhouse experiments. All herbicides tested, with the exception of atrazine, were found to significantly reduce the stand of fall panicum; alachlor was found most effective in fall panicum control when applied at preemergence. Ethylene at the rates of 0.001 and 1000.0 ppm at a 20-30 C temperature treatment appeared to inhibit the germination of 1971 fall panicum seed, while median rates seemed to stimulate germination. The coleoptile length was also significantly depressed at these same ethylene rates and temperature treatment. The only difference due to ethylene diffusing through the soil was on the number of fall (1971) plants emerging; 1970 fall panicum seed did not favorably germinate or emerge in any of the ethylene experiments, probably due to either seed dormancy or the low viability of the seed itself. Ethylene diffusion did not influence fall panicum plant weight or height significantly.

34801 **APTIC NO. 57775**

Sharma, G. K. and Joe Butler

LEAF CUTICULAR VARIATIONS IN TRIFOLIUM REPENS L. AS INDICATORS ENVIRONMENTAL POLLUTION. *Environ. Pollut., 5(4):287-293, Dec. 1973. 13 refs.*

Two populations of white clover (Trifolium repens L.) were studied from selected rural and urban areas of Tennessee, to determine the relationship between variation in flower production, leaf cuticular features, and the environmental pollution in the area. In the rural, Reelfoot Lake location, sulfur dioxide and ozone pollution was mainly due to vehicular traffic. In the urban, Nashville area, pollutants were mainly sulfur dioxide, ozone, particulate matter, carbon monoxide, and other oxidants from vehicular traffic, heating plants, textile plants, glass manufacturing plants, fertilizer plants, and a jet airport. In the rural area, stomatal frequency was 153.4 + or 14.1 (upper surface) and 44.3 + or 9.6 (lower surface), stomatal size range was 10-15 (upper) and 17-25 (lower), trichome density/sq cm was 25 (unicellular trichome on the lower surface) and 60 (multicellular trichome), trichome mean length was 82, subsidiary cell complex (cells) was 3-4, and average number of flowers/inflorescence was 69. The respective values for the urban area were 96.8 + or 10.3 and 37.2 + or - 7.8, 7-17 and 15-25, 60 and 123, 95, 3-4, and 47. Thus, stomatal frequency values were low in populations from areas of high pollution. Trichome frequency and length increased in polluted areas, and trichome type was also affected. Floral productivity decreased in polluted areas. Stomatal size range and the number of subsidiary cells remained the same in both populations.

34802 **APTIC NO. 57697**

Tingey, David T., Richard A. Reinert, Carlos Wickliff, and Walter W. Heck

CHRONIC OZONE OR SULFUR DIOXIDE EXPOSURES, OR BOTH, AFFECT THE EARLY VEGETATIVE GROWTH OF SOYBEAN. *Can. J. Plant Sci. (Ottawa) 53(4):875-879, Oct. 1973. 18 refs.*

Soybeans were exposed to low concentrations of ozone or sulfur dioxide, or both, during the first 3 wk of growth. Foliar injury occurred on both cultivars in the O3 and mixed treatments. Dare soybeans developed more foliar injury than Hood. Plant height, top and root fresh and dry weights, and the dry shoot-root ratios were significantly reduced by the 10 pphm ozone treatment. The mix of 5 pphm O3 plus 5 pphm SO2 significantly reduced top fresh weight, root fresh and dry weights, and shoot-root ratios. Treatments of 5 pphm O3 of 5 or 20 pphm SO2 had no significant effects on plant growth. The growth reductions resulting from the O3-SO2 mix were greater than the additive reductions of the single gases. The lack of a significant cultivar/treatment interaction indicated that the growth of the two cultivars responded similarly to the various treatments. (Author abstract)

34803 **APTIC NO. 56986**

Aichi Prefectural Government (Japan)

ANNUAL REPORT ON THE STATE OF ENVIRONMENTAL POLLUTION - ENVIRONMENTAL WHITE PAPER, 1972. *(Kogai no jokyo ni kansuru nenji hokoku - kankyo hakusho, Showa 47-nendo). Text in Japanese. 355p., Oct. 1973.*

The overall state of pollution damages inflicted on natural environment, plants, animals, and birds was investigated in 1972 by 60 schools in the prefecture. In the Nagoya area, tree mosses especially are investigated as an air pollution indicators. At 203 locations of Nagoya, mosses grew at 128 locations, and 37% lacked the moss growth, especially in south and southwest Nagoya. Other indicators are dragon flies and butterflies, which are drastically decreasing in number, and fireflies, which are specially protected, and certain rare wild plants. The total number of wild animals and birds has not changed much in recent years; but the species and locations show quite a change due to the development of industrial areas and intensive use of land; there is a definite tendency for an overall decrease of wildlife. Plans and programs for the protection of natural eviroment, further investigations, designation of natural reserves, promotion of vegetation, maintenance of parks and forests, and protection of natural life in general are discussed.

34804 **APTIC NO. 57680**

National Environmental Research Center, Research Triangle Park, N. C., Office of Research and Development

EFFECTS OF SULFUR OXIDES IN THE ATMOSPHERE ON VEGETATION: REVISED CHAPTER 5 FOR AIR QUALITY CRITERIA FOR SULFUR OXIDES. ***ROAP No. 26AAA, Task 16, Program Element 1A1001, EPA-R3-73-030, 56p., Sept. 1973. 141 refs.***

NTIS: PB-226314/AS

Limitation in the criteria for secondary standards in the publication Air Quality Criteria for Sulfur Oxides are discussed. Chapters 5 and 10, relating to the effects of sulfur oxides on vegetation, are revised. Effects of SOx in the atmosphere on vegetation are summarized, based on a literature review of 700 articles. For plants such as maple trees, spinach, and sweet potatoes that are sensitive to sulfur dioxide, damage or reduction in growth or yield may result from short-term exposures as low as 131 to 1316 micrograms/cu m (0.05 to 0.5 ppm) over an 8-hour period or 2620 to 10,480 micrograms/cu m (1.0 to 4.0 ppm) over period of 30 min. More resistent plants such as oak trees and corn may require exposures of over 5240 micrograms/cu m (2 ppm) for the 8-hour period or over 26,000 micrograms/cu m (10 ppm) for the 30-minute period. Growing season average concentrations as low as 26 tl 66 micrograms/cu m (0.010 to 0.025 ppm) have been reported to affect a large number or agronomic species. These averages were associated with maximum 30-minute values of 2096 to 4978 micrograms/cu m (0.8 to 1.0 ppm). Foliar and growth affects of mixtures of SO2 with other pollutants may be greater than the effects of SO2 alone, and nitrogen dioxide produces greater effects than either pollutant alone. (Author conclusions modified)

1972

34805 **APTIC NO. 56965**

Donaubauer, Edwin and Klaus Stefan

PROOF OF THE INCREASE IN POLLUTION EFFECTS AFTER THE CONSTRUCTION OF A THERMAL POWER STATION IN A FUME-DAMAGE AREA. ***(Nachweis der Vergroesserung von Immissonswirkungen nach Errichtung eines Kalorischen Kraftwerkes). Text in German. Mitt. Forst. Bundesvers., no. 97:151-161, 1972. 9 refs. (Presented at the International Symposium of Forest Fume Damage Experts, 7th, Essen, West Germany, Sept. 7-11, 1970.)***

In 1962, an additional pollution source went into operation in a valley basin (Aichfeld) already suffering (to an unknown extent) from sulfur dioxide pollution. Five years later, an investigation was made to find out whether this had caused a demonstrable increase in pollution in the adjacent forest areas. In addition to recording the individual pollution values, chemical needle analyses and core analyses were made. The annual ring curves and increment trend were determined by a graphical/computational method using Betterlich s curve compensating instrument. The data indicated that the amounts of SO2 emitted annually from the new source were two to three times greater than those of the other source of SO2 pollution. The orographic situation and the relative frequency of calms and inversions promoted temporary increase in air pollutants, especially in the region below about 900 m above sea level. The results of chemical needle analyses from different years indicated an increase in the pollution levels in the direction of the new pollution source. The percentage content of sulfur in the 1967 analyses in 1-year needles was between 0.08 and 0.18; in 1969, the values reached 0.25% sulfur in part of the region. Core analyses showed that, since 1962, decreases in ring width of up to 50% had occurred. Thus, the new pollution source has caused a considerable worsening of the forestry fume-damage situation in Aichfeld.

34806 **APTIC NO. 56964**

Grill, Dieter and Otto Haertel

CELL PHYSIOLOGICAL AND BIOCHEMICAL STUDIES SO2-FUMIGATED SPRUCE NEEDLES. RESISTANCE AND BUFFER CAPACITY. ***(Zellphysiologische und Biochemische Untersuchungen an SO2-Begasten Fichtennadeln Risistanz und Pufferkapazitat). Text in German. Mitt. Forst. Bundesvers., no. 97:367-386, 1972. 8 refs. (Presented at the International Symposium of Forest Fume Damage Experts, 7th, Essen, West Germany, Sept. 7-11, 1970.)***

The resistance of spruce needles to sulfur dioxide was investigated by plasmolysis and compared with the buffer capacity of homogenisates. In needles grown in direct light following 24 hours of artificial fumigation, dead cells were found only around the substomatal chambers. Much greater areas of the chlorenchyma were killed in needles grown in shade, following fumigation. The number of damaged cells did not increase as a function of the SO2 concentration. Following an initial rise, the alteration remained relatively constant over an SO2 concentration range of about 1:15. Concentrations above this lead to an abrupt rise in the curve until all cells are killed. Prealteration (even by urban air) increases the sensitivity to SO2. Homogenisates of leaves altered by SO2 (around pH 4) are less buffered than unaltered ones. In the alkaline range, the altered ones have a greater buffering capacity. Sulfur dioxide resistant needles from a tree grown in an industrial area were essentially similar to noncontaminated ones with respect to buffering capacity. As the needles grow older, their buffer capacity in the acid range is lowered, as is their resistance to SO2. In older needles, the acid peak of the buffer capacity is suppressed as in altered needles. Thus SO2 damage is comparable to the results of premature aging. The buffer capacity appears to control the SO2 resistance of spruce needles, especially under acute fumigation.

34807 **APTIC NO. 57289**

Grill, D. and H. Esterbauer

WATER-SOLUBLE SULFHYDRYL COMPOUNDS IN INTACT AND SO2-DAMAGED PINE NEEDLES. *(Wasserloesliche Sulfhydrilverbindungen in gesunden und SO2-geschaedigten Fichtennadeln). Text in German. Society for Ecology, Proc. Conf. Load Londability Ecosystems, Giessen, West Germany, 1972, p. 155-156. 2 refs.*

The cystein-SH and glutathione-SH contents in intact and sulfur dioxide-damaged pine needles were analyzed by comparative investigations. While both the ratio of the cystein-SH to the glutathione-SH, and the annual variations in the total sulfhydryl content are similar in intact and SO2-damaged pine needles, the total sulfhydryl content in SO2-damaged needles in summer is twice that found in intact needles in summer. The corresponding values measured in winter are up to four times higher in SO2-damaged needles than they are in intact needles.

34808 **APTIC NO. 56963**

Horvath, Iwan

EFFECT OF FLUORINE COMPOUNDS ON THE DRY MATTER PRODUCTION OF BUCKWHEAT. *(Einfluss von Fluorverbindunger auf die Trockensubstanzproduktion von Buchweizen). Text in German. Mitt. Forst. Bundesvers., no. 97:335-351, 1972. 17 refs. (Presented at the International Symposium of Forest Fume Damage Experts, 7th, Essen, West Germany, Sept. 7-11, 1970.)*

The effect of fluorine compounds applied to the soil before sowing, at the start of flowering, and during the ripening of the first fruits was evaluated according to the dry-matter production of Fagopyrum esculentum M (Doxanska variety). The application of fluorine in the rooting medium of the plants at different stages in their ontogeny produced results which indicated that the reduction in dry matter depended, inter alia, on the form in which the fluorine was applied to the soil. Under greenhouse conditions and on standard soil, the maximum inhibiting effect was found with sodium fluoride; the effect was less when fluorine was applied as potassium fluoride or calcium fluoride. In addition, the reduction in dry-matter production was more marked when the individual fluorides were applied before sowing. Increasing the fluorine level in the soil during flowering and during ripening of the first fruits did not cause significant reductions in dry matter, except in the case of sodium fluoride. The maximum inhibiting effect of sodium fluoride occurred when it was applied to the soil at the start of flowering; the effect was less when it was applied before sowing, and was not very significant when it was applied during the ripening of the first fruits. An increase in dry matter and leaf area was observed after a single application of fluorine on the 20th day of growth, indicating that calcium fluoride does not significantly affect the physiological processes of buckwheat during the first 6 weeks after application; the effect of sodium fluoride was quite different. The occurrence of necrotic leaves and the death of the most susceptible individuals were associated with a significant decrease in the formation of leaf surface area and with the reduction of dry-matter production. The most resistant individuals, as indicated by the responses to fluorine treatment, equalled or often even surpassed the control plants.

34809 **APTIC NO. 57412**

Levitt, J.

COMPARATIVE STRESS RESPONSES. *In: Responses of Plants to Environmental Stresses. Academic Press, 1972, p. 544-665. 2169 refs.*

The comparative stress responses of plants are discussed in terms of: comparative primary, secondary, and tertiary stresses; comparative primary strain responses; comparative resistance responses, including avoidance and tolerance; and a general tolerance hypothesis. Since the stresses to which a plant is subjected are so diverse, there must be some basic injury mechanism common to all of them. It is postulated that this mechanism involves oxidation-reduction or exchange reactions with membrane proteins, via their SH and SS groups, and leading to a loss of semipermeability. The plant can protect itself against this kind of stress injury by preventing or repairing such protein aggregations, which it does in more than one way. In some cases, however, the mechanism may involve mutually exclusive properties (e.g., if a plant is protected against the heat stress by high hydrophobicity, it must be sensitized to the chilling and freezing stress, and vice versa), and, in some cases, the mechanism may not be sufficient by itself.

34810 **APTIC NO. 57620**

Munshower, Frank

DISTRIBUTION AND COMPARTMENTATION OF CADMIUM IN AN ARID GRASSLAND ECOSYSTEM. *Preprint, American Institute of Biological Sciences, Washington, D. C., 20p., 1972. (Presented at the American Institute of Biological Sciences Meeting, Minneapolis, Minn., Aug. 29, 1972.)*

The distribution of cadmium in soils, plants, and animals and the movement of Cd through the food chain from soil to plants to herbivores was studied between 1969 and 1971 in the Deer Lodge Valley of Montana. This valley has been polluted by emissions from the smelter complex at its southern end for over 80 years. Soils, flora, and fauna were sampled at different distances from the smelter. Heavy Cd pollution occurred within 2 to 3 mi of the smelter. Sites examined in this zone generally showed significantly lower soil pH values than other sites in the valley and greater Cd movement. Utilizing data collected in the study of Cd in plants and animals on the state prison pastures 15 miles from the smelter, a hypothetical ecosystem was constructed. Three compartments were recognized: soil, producers, and herbivores. A computer simulation of the ecosystem was developed. The model indicated that under the present grazing system, soil Cd levels will not be appreciably reduced for several hundred years and that if even small increments of Cd are added to the ecosystem along with the other heavy metals liberated by the smelter, the agricultural productivity of this valley will continue to be degraded.

1971

34811 **APTIC NO. 57475**

Bohne, Helmut

CHANGES OF THE LANDSCAPE CAUSED BY INDUSTRIAL SMOKE ACIDS. *(Ameny v drajine zpusobene emitovanymi kyselinami). TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 14-17. (Sept.)*

The influence of industrial smoke emissions of sulfur dioxide, fluorine, and chlorine on landscape is examined. Sulfur dioxide emission has been estimated to cause 80% of the plant damage found near industrial surroundings according to the literature, but more recent evidence has pointed to fluorine-containing exhaust as being the main culprit of smoke damage. Two examples are presented in favor of the latter hypothesis. Fluorine containing exhausts have been found to cause damage in gladiolas, horse-chestnuts, damson plums, apricots, forest plants; leaf burning and permanent damage have been common. Plant damage has also been observed in the vicinity of chlorine-emitting facilities. Growth depression, bleached or lightened leaves, and necroses have been observed. Damage to pear leaves from chlorine appeared as ill defined, brown necroses in contrast to the sharply defined black-brown edges resulting from fluorine damage.

34812 **APTIC NO. 57476**

De Sloover, Jacques

ECOLOGIC GROUPS, COMBINATIONS OF INDICATOR SPECIES AND TOLERANCE FOR POLLUTANTS IN EPIPHYTIC LICHENS. *(Groupes ecologiques, combinaison d especes indicatrices et tolerance a l egard des pollutions chez les lichens piphytiques). Text in French. TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 18-24. 9 refs. (Sept.)*

The method of the average specific concomitants, and the method of the relative cumulative frequencies, both applied to the study of the air quality by determining changes in the composition of associations of epiphytic lichens due to air pollution, are compared. The method of the average specific concomitants derives air quality indices from the average number of epiphytes surrounding a given species in a given site. Compared to the former, the method of the relative cumulatives frequencies delivers more precise data on the air pollution-generated changes in the composition of epiphytic associations. Twenty-eight out of a total of 65 epiphytic species found in the Dendre valley (Belgium) have been retained on the basis of their absolute frequencies for the determination of the relative cumulative frequencies to obtain groups by variance analysis, adopting two-by-two comparisons.

34813 **APTIC NO. 57480**

Garber, Kurt

EFFECTS OF AMMONIA EMISSIONS ON PLANTS. *(Wirkungen von Ammoniakimmissionen auf Pflanzen).*

Text in German. TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 46-47. 13 refs. (Sept.)

Cases of plant and fruit damages due to ammonia emissions are described. Reddish-brown, and then dark brown to grayish-black coloration of plant leaves due to NH3-containing gases was observed. Ammonia released by manure in stables and greenhouses caused damages to lettuce, cucumber, roses, and Picea omorica. Leaf damages on pot flowers due to the previous use of NH3 liquor for varnish removal were observed. Round, brown lenticel spots of 2-4 mm in diameter were produced in applies due to the release of NH3 from the cooling system in a ship.

34814 **APTIC NO. 57485**

Krivoluckij, Dmitrij Alexandrovic

THE INFLUENCE OF MINERAL FERTILIZERS, PESTICIDES AND RADIONUCLIDES ON THE SOIL FAUNA. *(Einfluss von Mineralduengern, Pestiziden und Radionukliden auf die Bodenfauna). Text in German. TERPLAN- Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 78-82. 25 refs. (Sept.)*

Studies on the effects of mineral fertilizers, pesticides, and radioactive isotopes, as used for scientific purposes, on the soil microorganisms are reviewed. Soil contamination with strontium 90 and yttrium 90 in doses of 1.8-3.4 mCi/sq m in gray forest soil resulted in noticeable changes in the soil fauna, and especially in soil-surface and near-surface populations of Lumbricidae, Lithobiidae, Geophilidae, Diplopoda, and Oribatoidea species. Increased leaf damages due to insects in trees growing on contaminated sites were noted. Reductions in both the density of the specimens and in the number of the soil microfauna in radionuclide-contaminated places were evidenced.

34815 **APTIC NO. 57109**

Nikolayevskiy, V. S., V. N. Tsodikova, V. V. Firger, A. T. Miroshnikova, V. V. Suslova, and V. P. Galeyeva

ANATOMICAL-MORPHOLOGICAL AND PHYSIOLOGICAL-BIOCHEMICAL PRINCIPLES OF PLANT GAS STABILITY. *(Vliyaniye anatomo-morfologicheskogo stroyeniya list er i biologicheskikh osobennostey dekorativynykh rasteniy na pogloshcheniye S3502 i gasoustoychivost). Uch. Zap. Perm. Gos. Univ., no. 256:5-53, 1971. 16 refs. Translated from Russian, 53p.*

The effect of the anatomical-morphological structure of leaves and biological features of ornamental plants on the absorption of sulfur-35 dioxide and on the stability of the gas were investigated. There was a dependence of gas tolerance on the phases of growth and development of the plants and on the rate and times of passage through phases. A greater tolerance to sulfur gas was manifested by species with a longer growing season and shortened flowering times. There was a direct, statistically reliable correlation between the damageability and intensity of gas exchange and absorption of sulfur dioxide in woody, flowering, lawn, and weedy plants. There was a close parallel similarity in the tolerance of woody plants to SO2 and chlorine, opposite to that of ammonia. The rate of gas absorption and formation of the lethal concentration of S35O2 is dependent on the number of stomata and the dynamics of their movement during the daytime, thickness of cuticle, membrane of the epidermis, and the epidermis itself, thickness of the spongy tissue, ventilability of the spongy parenchyma, and value of the h sub n/h (sub r) ratio. Xeromorphicity of leaf structure characterizes gas tolerant species, while mesomorphicity is characteristic of nontolerant species. (Author summary modified)

34816 **APTIC NO. 57474**

Novakova, Eliska

BIOINDICATORS AND THEIR VALUE IN THE CONTROL OF ENVIRONMENTAL DETERIORATION. *(Indicateurs biologiques et leur valeur dans le controle des deteriorations de l environnement). Text in French. TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 5-13. 30 refs. (Sept.)*

Problems and significance of bioindicators of environmental pollution are outlined. Non-vascular epiphytes are used for the determination of the degree and extention of air pollution. The use of plants and animals as bioindicators for the diagnosis of the hygienic aspect of the environment, though very promising, is in an experimental stage. For complex studies of environmental degradation, species and groups of species, usable in a major part of the temperate climactic zone, should be selected. Synergism, inhibition, and antagonism in the action of environmental pollutants on bioindicators, changes in the susceptibility of the latter to pests, adaptation and sensibilization are among the factors complicating the use of bioindicators. The physiologic barrier to the penetration and assimilation of noxious agents into the bioindicator organism is constituted mainly by epithelial tissues. Silvery, vitrous, bronze, or metallic coloration of the inferior surface of plants is indicative of peroxyacetylnitrate.

34817 **APTIC NO. 57487**

Novakova, Eliska

THE UTILIZATION OF WILD MAMMALS AND BIRDS AS BIOINDICATORS OF ENVIRONMENTAL POLLUTION. *(Utilisation des mammiferes et des oiseaux sauvages comme indicateurs biologiques de la pollution de l environnement). Text in French. TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 86-92. 12 refs. (Sept.)*

Possibilities of the use of wild mammals and birds as biological indicators of environmental pollution are described. The hemoglobin and hematocrite levels, possibly the globular saturation, the blood albumin levels, and the urine pH can be used for the detection of air pollution. Decreased hemoglobin and hematocrite levels, and reduced globular saturation were measured in rabbits caught in areas where the sulfur dioxide concentration exceeded double the maximum allowable level of 0.15 mg/cu m. Highly significant increases in the total protein, albumin and globulin levels (except for the beta-globulin level), and reduction of the albumin:globulin ratio were measured in animals living in polluted areas. The urine pH measured in rabbits caught near cement works ranged from 5.2 to 8.6%, while in rabbits living in fly ash-polluted area the urine pH was slightly more acidic than in normal rabbits. The urine pH values measured in rabbits in areas polluted with SO2 were by 4.8 to 11.6% more acidic than the normal value of 7.3.

34818 **APTIC NO. 57481**

Paukert, Jindrich

POSSIBLE USE OF POTATO TUBERS (SOLANUM TEBEROSUM) FOR THE INDICATION OF SOME ELEMENTS PRESENT IN INDUSTRIAL IMMISSIONS. *(Mozne vyuziti hliz bramboru (solanum tuberosum) jako indikatoru nekterych prvku pritomnych v prumyslovych imisich). TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 48-52. 7 refs. (Sept.)*

Potato tuber pulp samples obtained from an industrially- contaminated locality contained molybdenum in 100% of the cases as compared to 5% occurrence for those from control plots;

lead was found in 55% as compared to 15% for controls; chromium was found in 30% of the samples as compared to 5% for controls; and tin was observed in 10% as compared to 0% for controls. Molybdenum, whose occurrence rate fluctuated to a considerable degree in the pulp samples, was represented by equal quantities in all peel samples. Soil samples from both areas showed an absence of molybdenum, whereas the industrial emissions were positive for the metal. Lead was present in emissions in quantities larger by one order than for soils and tubers. Chromium was found in emissions, soil, and tuber samples. Tin was found in the emissions and the contaminated tubers.

34819 **APTIC NO. 57491**

Pelz, Eberhart

FOREST AS A BIOINDICATOR OF AIR POLLUTION-GENERATED LANDSCAPE DETERIORATION. *(Der Wald als Bioindikator einer Landschaftdeteriorisation durch Luftverunreinigung). Text in German. TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ecologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 111-118. 31 refs. (Sept.)*

Possibilities and methods of the use of forests as bioindicators of air pollution are discussed. Due to their large extension and longevity, forests, especially coniferous, are especially suitable for indicating air pollution in chronic and acute exposures. Industrial emissions cause rarefaction of species in soil, phytocenoses, and zoocenoses. The color, size, shape, density, anatomic and biochemical features of the needles, and the rate of growth of the individual tree can be used as criteria for the determination of the effect of air pollutants. Aerial color photographs of forests permit the delimitation of damage zones on the basis of differences of color in an objective manner.

34820 **APTIC NO. 57492**

Pelz, Eberhart

STUDIES ON PINES AS BIOINDICATORS OF AIR POLLUTION. *(Uuntersuchungen in Richtenbestaenden als Bioindikatoren fuer Luftverunreinigungen). Text in German. TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 119-125. 3 refs. (Sept.)*

Factors modifying the degree of smoke damages in pine forests were studied. Close interrelationships between the degree of the smoke damage, the age and site of the tree, weather conditions, and the pollution levels were established. Trees living under labile conditions were most susceptible to influencing factors such as air pollution. Reduction of the number of normally needled trees with increasing pollution levels was observed. Reduction of the number of normally-needled trees only in higher age groups was determined in forests with reduced pollution level, while in forests with high pollution levels, the reduction is nearly independent of the age of the trees.

34821 **APTIC NO. 57486**

Pfeffer, Antonin

INSECTS AS BIOINDICATORS. *(Insekten als Bioindikatoren). Text in German. TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 83-85. 15 refs. (Sept.)*

Possibilities for using insects as bioindicators of environmental deterioration, including air pollution, are surveyed. Changes in the soil conditions are indicated by Collembola, Protura, and Oribatoidea species. The rarefaction of phytocenoses due to environmental degradation is signaled by monophagous and oligophagous insect species, such as Homoptera, Heteroptera, Coleoptera, Lepidoptera, Hymenoptera, and Orthoptera. The decay of Conifera, e.g., due to sulfur dioxide and fluorine compounds, is indicated by the proliferation of Phaenops cyanea F., Exoteleia dodecella L., Paururus noctilio L., Dreyfusia piceae Ratzb., Hylurgops palliatus Gyll., Dryocoetes autographus Ratzb., Trypodendron lineatum Ol., Pissodes harcyniae, and P. scabricollis Mill.

34822 **APTIC NO. 57477**

Renft, Horst

STUDIES ON THE SMOKE RESISTANCE OF LICHENS AND MOSSES UNDER THE INFLUENCE OF SULFUR DIOXIDE. *(Untersuchungen zur Rauchhaerte von Flechten und Moosen unter Schwefeldioxideinfluss). Text in German. TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 25-29. 12 refs. (Sept.)*

The effect of sulfur dioxide on over 30 lichen species and about 20 moss species was studied in fumigation experiments of 22-60 hr, using SO2 concentrations of 0.6 ppm, 1.4 ppm, and 3 ppm. Judged by visible changes in the appearance of the species (discoloration and necrosis, starting out usually from the external parts), the lichen species Parmelia furfuracea Ach., Hamalina (farinacea), Cladonia bellidiflora Schaer, Cetraria clorophylla Vain., C islandica Ach., Alestoria jubata Ach., P. physodes Ach., Cl. alcicornis Floerke, Cl. arbuscula Ragenh., Cl. rangiferina Weber, Cl. coniocraea Vain., and Umbilicaria hirsuta Ach., as well as the moss species Sphagnum spp., Anastrepta orcadensis Schiff., Polytrichum commune L., Polytrichum juniperinum Willd., Plagiothecium undulatum Br. Eur., Atrichum undulatum P. Beauv., Dicranum scoparium Hedwig., Hypnum cupressiforme L., Hylocomium splendens Br. Eur., Mnium hornum L., Mnium affine Blandow, and Lepidocia reptans Dum. were very sensitive to SO2. The lichen species Rhicocarpum geographicum Dc., Lecanora varia Ach., and Lecidea scalaris, as well as the moss species Pohlia nutans Lindb., and Dicranella heteromalla Schimp. were more or less SO2-resistant. Specimens of highland origin were usually more susceptible than lowland specimens of the same species. Considerable regression of Cladonia arbuscula, Cl. rangiferina, Cetraria islandica, Parmelia spp., C. chlorophylla, and C. pinastri in Erzgebirge (East Germany) was noted.

34823 **APTIC NO. 57478**

Schoenbeck, H. and H. van Haut

MEASURING AIR POLLUTANTS BY MEANS OF INDICATOR PLANTS. *(Messung von Luftverunreinigungen mit Hilfe pflanzlicher Organismen). Text in German. TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 30-38. 43 refs. (Sept.)*

Possibilities of the use of plants as bioindicators of air pollution in general and of air pollution components in particular are described. Visible and physiological changes, accumulation of air pollutants in the plant organism, and changes in the composition of phytoassociations are among the principal consequences of exposure to air pollutants, making the use of plants as bioindicators possible. Plants can be used in exposure chamber tests in which plants are grown under identical conditions with filtered or unfiltered air. The test plant method uses plants grown under identical conditions within and beyond the emission-affected area. When used in such tests, Brassica oleracea acephala is suitable, apart from reflecting the overall pollution level, for the detection and accumulation of polycyclic aromatic hydrocarbons along with lead, fluorine, and chlorine. The poisoning hazards faced by animals can be determined by grass patches in fluorine emission areas. Epiphytic lichens and mosses were found to be true indicators of air pollution, and even of short-term pollution episodes. The longitudinal growth of the *Lepidium sativum* roots was found suitable for the detection of pollutants with an auxinic effect.

34824 APTIC NO. 57483

Stepan, Jan

BIOINDICATORS IN LANDSCAPE ECOLOGY (WITHIN THE FRAMEWORK OF TERRITORIAL PLANNING). *(Bioindikatoren in der Landschaftsoekologie (im Rahmen der Gebietsplanungspraxis)). Text in German. TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, p. 126-133. 13 refs. (Sept.)*

General problems and possibilities of the use of biological indicators of landscape deterioration in territorial planning areas are discussed. Bioindicators signaling the negative anthropogenic influence on the environment now permit objective data for territorial planning decisions to be obtained. While the biological indication of the excess or deficit of certain elements and compounds in the soil is possible by means of indicator plants, the effect of a multitude of simultaneously acting factors, which is the case usually in practice, is very hard to detect in a specific manner. Examples of negative anthropogenic factors and their biological indications are presented. Disappearance of certain plant species, reduction of plant production, and degradation of the original vegetation were observed in highly polluted areas

34825 APTIC NO. 57482

Svachn, Jaroslav

THE EFFECT OF POWER PLANT FLY ASH ON THE CONTENTS OF ELEMENTS IN SOME CROPS. *(Vliv elektrarenskych popilku na obsah prvku v nekterych polnich plodinach). TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 52-56. 13 refs. (Sept.)*

Investigations concerning the effect of power plant fly ash on the elemental contents of soils and plants indicate that rye, vetch, flax, and, perhaps wheat might be used for indications of landscape deterioration. The stalks of plants studied took up only the bioelements iron and calcium in larger than normal amounts; the same was found for aluminum and silicon, elements of unknown or vague function. Highest penetration into the soil exposed to the effect of fly ash was found for iron and silicon (10%); while aluminum, sodium, calcium, and magnesium were next with 1% retention. Toxic elements such as lead and arsenic for example were found in plants growing in soils with a larger fly ash admixture or in pure fly ash.

34826 APTIC NO. 57490

Tollinger, Vladimir

SYLVAN BIOCENOSES AS BIOINDICATORS OF INDUSTRIAL EMISSIONS. *(Waldzoenosen als Bioindikator der Wirkung von Industrieexhalationen). Text in German. TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 107-110. 17 refs. (Sept.)*

A method for the bioindication of industrial emissions by the production loss of Conifera is exemplified by an industrial emission-damaged coniferous forest in Czechoslovakia. The degree of the forest damage was determined from the production loss of age group 4 trees, and expressed as a percentage of the last inventory. The isolines of the stock losses, obtained by interpolation, were drawn up on charts. The differences of the smoke-resistance and the adaptability of the different species were taken into account by studying changes in the composition of the forest regarding the individual species that have taken place for the last decade.

34827 APTIC NO. 57485

Vanek, Jan

ZOOCENOLOGIC BIOINDICATION OF SOIL DETERIORATION. *(Die Methode der zoocoenologischen Bioindikation der Bodendeteriorisation). Text in German. TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 61-71. 12 refs. (Sept.)*

Possibilities of the zoocenological bioindication of anthropogenic soil degradation, such as due to air pollution, are outlined. The application of zoocenological bioindication requires the determination of those properties and characteristics of soil zoocenoses that are suitable for signaling anthropogenic changes, of the susceptibility and reactivity of such properties, of the action mechanisms of anthropogenic factors, and of species that are suitable for use as specific bioindicators. Shifts in the species composition, in the density, appearance, and disappearance of certain species usually are indicative of anthropogenic factors.

34828 APTIC NO. 57484

Vanek, Jan

INDUSTRIAL EMISSION-GENERATED CHANGES IN MOSS ASSOCIATIONS. *(Durch Industrieimmissionen verursachte Veraenderungen der Moosmilbenschaften). Text in German. TERPLAN-Statni ustav pro uzemni planovani, Ustav krajinne ekologie CSAV, Bioindikatory Deteriorizace Krajiny, Sbornik Z Mezinarodni Konference, Prague, Czechoslovakia, 1971, p. 73-77. 7 refs. (Sept.)*

Qualitative and quantitative changes in Acarina and Oribatoidea associations in the upper 5 cm-layer of the soil due to increased soil temperature and the release of combustion products as a result of underground fires in a coal mine were studied by comparison with control growths. The absolute numbers of the species found in the damaged and control situations were 66 to 113, a difference of 41.6%. The density was 69.45% lower on the damaged than on the undamaged sites. The dominance of the Oribatoidea in the damaged group was lower by 27.5%. The qualitative and quantitative homogeneities in the damaged cenoses were 24.7% and 63.3% lower than in the undamaged cenoses. Species with low dominance were most damaged. Differences in the site and time of the sampling influenced the results much less than the emissions.

1970

34829 APTIC NO. 57486

Abrahamse, Marien

AIR POLLUTION IN RELATION TO GREEN-HOUSES. *(Luchtverontreiniging in de glastuinbouw). Text in Dutch. Tuinbouwberichten, 34(6):229-231, 1970.*

Problems of air pollution-inflicted indirect damages in greenhouse production are described. The steady increase of air pollution, and especially of the dust concentrations in the Netherlands during the last years has led to increased soiling of the glass panes in greenhouses, which results in reduced production due to light attenuation. As conventional cleaning of the glass panes with water is no longer sufficient, 3% solution of oxalic acid is used for the removal of dust from the panes. Then use of natural gas instead of solid and liquid fuels, postcombustion of flue gases for the abatement of fly ash and other particulate matter emissions, and the erection of high stacks are among the possibilities to alleviate production damages in greenhouses.

34830 **APTIC NO. 57107**

Nikolayevskiy, V. A. and V. V. Firger

ANATOMICAL-MORPHOLOGICAL AND BIOLOGICAL CHARACTERISTICS OF ORNAMENTAL PLANTS IN RELATION TO THEIR GAS TOLERANCE. *(Anatomo-mor-fologicheskays u biologicheskaya kharakteristika dekorativyykh rasteniy v svyazi s ikh gazoustoychivost yu). Uch. Zap., Perm. Gos. Univ., no. 206:135-147, 1970. 14 refs. Translated from Russian, 24p.*

The anatomical-morphological and biological characteristics of ornamental plants were investigated in relation to their tolerance to sulfur dioxide gas. A close reliable correlation was established between the damageability of leaves by SO2 and the number of stomata/l sq mm, size of the stomata, and thickness of the upper epidermis of the leaf. Gas-tolerant plants are characterized by a greater number of stomata/l sq mm, smaller stoma size, and lesser thickness of the upper epidermis. A particularly clear inverse correlation between damageability and the number of stoma is observed in plants having stomata, as in woody plants, on the lower side of the leaf. There was no reliable correlation between the gas tolerance of plants and thickness of leaf cuticle and the thickness of the epidermal membranes. Some correlation exists between the gas tolerance of plants and their winter tolerance. Light-loving ornamental plants were more gas tolerant than shade tolerant and shade loving plants. There was some dependence of the gas tolerance of plants on the times and duration of flowering, as well as coloring of the generative organs. (Author summary modified)

EFFECTS-MATERIALS

1973

34831 **APTIC NO. 57323**

Duncan, J. R. and D. J. Spedding

INITIAL REACTIONS OF SO2 AFTER ADSORPTION ON TO METALS. *Corrosion Sci., vol. 13:881-889, 1973. 30 refs.*

An electrophoretic method for separation of labelled corrosion products from metals exposed to laboratory atmospheres containing natural concentrations of sulfur dioxide (35) indicated that on iron and zinc such products are exclusively sulfur (IV) species and sulfate. Equal half-lives of approximately 24 hr were found for the formation of sulfate on both iron and zinc, suggesting a different picture from that of bulk solution mechanisms occurring in the electrolyte layer on the metal surface. Both a surface electrolyte solution reaction (SESR) model and a specific adsorption site (SAS) model would explain most of the experimental results satisfactorily. Pseudo-first order kinetics could be explained in each case as being due to the ready availability of oxygen from the atmosphere, thus maintaining a constant dissolved oxygen content in the surface electrolyte. Autoradiography of zinc after exposure to SO2 (35) does not differentiate between the two models, but SAS offers a more convincing explanation for discrete areas of uptake found on iron than does SESR.

34832 **APTIC NO. 57293**

Palit, B. B.

MODELING BREAKDOWN DUE TO FOREIGN MATERIAL LAYER. *(Fremdschichtueberschlag an einer Modellanordnung). Text in German. Bull. Assoc. Suisse Electric., 64(20):1239-1247, Sept. 1973. 1 ref.*

Breakdown processes occurring in electric means and distribution networks in polluted areas, and especially nearby fly ash-emitting thermal power plants, were modeled by means of a glass plate with electrodes at both ends between which a nekal solution, having a resistivity corresponding to that of settling dust, was applied in a straight line. Initial arcs were found to occur both between the electrode and the adjacent end of the foreign layer, and between the two ends of the foreign layer, separated due to the dry-up of the latter. Increases in the conductivity of the foreign material layer due to rise in temperature and field intensity were determined, as the foreign layer acts as an electrolyte. Evaporation of the foreign layer and thermionization at the foot of the arc were observed. An increase in the conductivity of the foreign layer due to warming-up and increased field intensity, and a reduction of the resistivity of the foreign layer were determined as the basic factors facilitating breakdown. The development of initial arcs was a physical condition necessary for the breakdown in the foreign layer to occur.

1972

34833 **APTIC NO. 57630**

Campbell, G. G., G. G. Schurr, and D. E. Slawikowski

A STUDY TO EVALUATE TECHNIQUES OF ASSESSING AIR POLLUTION DAMAGE TO PAINTS. (FINAL REPORT). *Sherwin-Williams Co., Chicago, Ill., Research Center, Environmental Protection Agency Contract 68-02-0030, EPA-R3-73-040, 97p., May 1972. 13 refs.*

NTIS: PB 222377

Erosion rates studied by ATR measurements and SEM analyses provide a definitive technique for determining the effect of atmospheric pollutants on the performance of exterior coatings. This technique is based on the use of a gas controlled, Xenon Arc type Weather-Ometer. The other methods of testing that were investigated tensile strength, gloss or sheen, and surface roughness provided considerably less consistent trends in data for either the short term exterior exposure or the Weather-Ometer studies. Atmospheric pollutants at levels representative of a highly polluted industrial site (1.0 ppm sulfur dioxide or ozone) exert a significant adverse effect on the performance of specific coatings compared to the zero pollutant conditions. In general, 1.0 ppm SO2 had a considerable effect on the oil house paint, a moderate effect on the latex and coil coatings, and no effect on the alkyd industrial maintenance paint and the automotive refinish. Sulfur dioxide at the 1 ppm level affected these coatings to a greater extent in the shaded and unshaded conditions than did 1 ppm O3. Graphs of erosion rate versus pollutant level support the hypothesis that erosion rates are linearly related to pollutant concentration. The ranking of a coating in terms of erosion rates was shown to be virtually independent of exposure to a pollutant type or level. The erosion rates for coatings exposed at the Chicago and Valparaiso exterior testing sites were higher than at the Los Angeles and North Dakota locations. This trend in the data is explained by the higher SO2 levels at the two former exposure sites. The ATR measurements and SEM photomicrographs also support this contention. The ranking in terms of mils loss was virtually the same as the erosion rates generated in the Weather-Ometer studies regardless of exposure location (both north and south). (Author abstract)

34834 **APTIC NO. 57272**

Evans, R. M.

AN ASSESSMENT OF THE ATMOSPHERIC CORROSION RESISTANCE OF HOT DIPPED GALVANISED STEEL AFTER FIVE YEARS EXPOSURE. *Preprint, British Steel Corp., Port Talbot (England), Research Center, 17p., 1972. 43 refs.*

Data are presented from an assessment of the atmospheric corrosion resistance of hot dipped galvanized steel after five years of exposure to industrial, marine, and rural conditions. Corrosion rates and coating lives were assessed for skyward and groundward facing aspects and for samples exposed in louvred boxes (sheltered from direct contact with rain, wind, and atmospheric debris but freely accessible to air). The loss of coating with time at the two severest sites (industrial-urban site and marine site) for both skyward and groundward faces displayed rectilinear kinetics, indicating that the frequency of film reparation was sufficient only to maintain the status quo. Coating time curves showed varying degrees of flattening at the remaining sites, indicating the establishment of protective films. Breakdown of the protective film in industrial and urban sites was primarily implemented by sulfur dioxide adsorption, considered the most important contaminant in the atmospheric corrosion of zinc. Breakdown of the initially formed protective film in the marine environment probably proceeded via attack by chloride ion.

34835 **APTIC NO. 57622**

Veith, A. G.

A RAPID QUANTITATIVE METHOD FOR MEASURING OZONE CRACKING AND ITS USE IN OUTDOOR DYNAMIC TESTING. *Rubber Chem. Technol., 45(1):293-308, March 1972. 8 refs. (Presented at the American Chemical Society, Division of Rubber Chemistry Meeting, Cleveland, Ohio, Oct. 12-15, 1971.)*

A fairly rapid quantitative technique for measuring the cracking damage done to rubber by ozone has been described. The method consists of microscopic measurement of the length and width of selected ozone cracks. The product of the average length and width is termed the severity of ozone cracking and is abbreviated SOC. The SOC value for a specimen is approximately two times the void area in arbitrary units. The use of the SOC technique in conjunction with an outdoor dynamic ozone test showed how various antiozonants performed in NR, SBR, and OE-SBR both with and without wax. Some effects of the amount and type of extending oil and of wax melting points are illustrated. Weather plays an important role in ozone attack especially for wax-containing compounds. During the warmer months higher melting waxes perform better in natural and OE-SBR while higher melting waxes perform poorly in non-oil extended SBR. Good correlation was found between the outdoor flexing tests and service type outdoor tire tests carried out on an outdoor wheel. Some of the ramifications of this type of testing are pointed out. (Author summary)

1969

34836 **APTIC NO. 57556**

Dasgupta, D.

MECHANISM OF ATMOSPHERIC CORROSION OF STEEL A REVIEW. *Brit. Corros. J., 4(3):119-121, May 1969. 28 refs.*

Investigations on the increased rate of corrosion of steel owing to the presence of sulfur, ammonia, and chlorine in the atmosphere are reviewed. The characteristics of rust and the process of corrosion are described. Corrosion cannot occur at a relative humidity of less than 70% unless salts are present on the steel. The corrosion rate of steel is increased by the presence of sulfur dioxide in the atmosphere. The ultimate reaction product between SO2 and steel is ferrous sulfate. Ferrous sulfate first develops as bands and later occupies the anodic areas of the corroded surface. The SO2 may act as a cathodic depolarizer which in turn increases the overall corrosion rate. Iron sulfide may form during atmospheric rusting and may increase corrosion by stimulating the anodic process. The presence of certain ammonium salts accelerates the corrosion process. The principle effect of the ammonium ion may be that it promotes wetting and the subsequent involvement of greater areas of metal. Chlorides of iron tend to be very soluble, and their influence on the increased corrosion of steel is probably associated with the increased conductivity of the electrolyte.

34837 **APTIC NO. 57559**

Matsushima, Iwao and Tadayuki Ueno

ON THE NATURE OF ATMOSPHERIC RUST ON STEEL. (II). BEHAVIOR OF SULFUR DIOXIDE IN THE ATMOSPHERE AND SULFUR IN STEEL. *(Tekko no taikibakurosabi ni kansuru kenkyu. II. Taikichuh no aryuhsangasu to kohchuh no ioh no kyodoh). Text in Japanese. Bohshoku Gijutsu (Corrosion Engineering, Tokyo), 18(2):19-27, Feb. 1969. 23 refs.*

The rate of sulfate formation in rust, its removal by water treatment, and the behavior of sulfur content in steels were studied to clarify the difference in behavior of low-alloy weathering and high-strength steels in atmospheric corrosion. The rate of sulfate formation was obtained by exposing the samples to a radioactive sulfur dioxide environment for a few days after pre-exposure to an industrial atmosphere for 9 to 25 months, and subsequently measuring the radioactivity of the sulfate. The rate of dissolution of the radioactive sulfate was determined either by immersion in distilled water or by spraying tap water on the surface. The rate of sulfate formation was lower for the weathering steels, as well as for either type of steel pre-exposed to the atmosphere for longer periods. The amount of dissolved sulfate was less for the weathering steels, but its percentage remained almost the same regardless of steel composition. During atmospheric corrosion, sulfur changed to sulfate and accumulated in rust when copper was absent, but the presence of copper drastically reduced the sulfate formation. The material balance of sulfate in rust films was also considered, and corrosion resistance of weathering steels in relation to the behavior of the sulfate was discussed.

34838 **APTIC NO. 57381**

Okada, Hideya, Yuzo Hosoi, Ken-ichi Yukawa, and Hiromitsu Naito

STRUCTURE OF THE RUST FORMED ON LOW ALLOY STEELS IN ATMOSPHERIC CORROSION. *(Taikohseikoh no sabisoh no kohzoh). Text in Japanese. (Tetsu to Hagane, 55(5):355-365, April 1969. 25 refs.*

A plain carbon steel and two types of atmospheric corrosion resisting steels, were exposed to the atmosphere for 1-5 years at industrial, sea-side, suburban, and urban locations. Use of reflected polarized light and crossed nicols in microscopic observation of the polished cross-section of the rust made it possible to distinguish between optically active and optically isotropic layers in the rust. In the atmospheric corrosion resisting steel, the metal surface was almost completely covered with the optically isotropic layer after 5 years of exposure to the atmosphere at the industrial site. X-ray diffraction and cathodic reduction of the rust revealed that this optically isotropic layer was composed of amorphous spinel-type iron oxide. This amorphous iron oxide is considered to be a polymeric ol-compound. The ferroxyl reagent and scanning electron- microscopy showed a denser amophous layer on the low alloy steels than on the plain carbon steel. The enrichment of copper, chromium, and phosphorus in the optically isotropic layer was found by means of electron probe microanalysis. The significant corrosion resistance of atmospheric corrosion resisting steels was deduced to be attributed to the formation of this amorphous layer. Alloying elements, such as Cu, Cr, and P, may be beneficial to the formation of this layer--Cr for the formation of the spinel compound, and Cu for the prevention of the crystallization of the compound.

EFFECTS-ECONOMIC

1974

34839 **APTIC NO. 57515**

Fraser, Malcolm D., Clinton C. Kemp, Douglas R. Eaton, and Gary J. Foley

COST MODELS FOR FABRIC FILTER SYSTEMS. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 3p., 1974. (Presented at the Air Pollution Control Association Annual Meeting, 67th, Denver, Colo., June 9-13, 1974.)*

Cost models were developed to describe both the capital and operating costs of fabric filter systems. Unlike previous cost correlations, these cost models are comprised of the cost of the major subcomponents, rather than simply the cost of the entire system. In addition, costs are keyed directly to factors in the fabric filter which are the source of its cost, such as the area of its filter surface, type of fabric, pressure drop, and air flow rate. Previous cost correlations have simply related the cost to the flow rate of the gas treated.

34840 **APTIC NO. 57529**

Waddell, Thomas E.

ENVIRONMENTAL POLLUTION CONTROL AND HEALTH BENEFITS. *Preprint, Mitre Corp. and American Geophysical Union, 17p., 1974. 7 refs. (Presented at the Symposium on Economics of a Clean Environment, Washington, D. C., Jan. 14-16, 1974.)*

Air resource management requires a basis of information on the costs of abating pollution so that decisions can be made. Information must be available to the decision-maker so he can consider the tradeoffs of feasible options. A cost-benefit analysis must consider human health effects as the highest priority. Economically speaking, the concept of health benefits is the willingness to pay for improved health. However, this willingness-to-pay approach is difficult to use. The traditional method of valuing human health has been to sum the loss of output and the cost of medical care; but there is still the problem of whether the present value of the decendent s consumption should be subtracted from the present value of his earnings in order to get at some sort of net value. The reasoning is that if the person would have produced, he also would have consumed. A measurement of the value of time lost would be better than the lost productivity approach. Health costs, with effective air pollution abatement, become health benefits. Health benefits can be quantified by determining the biological-human response or physical damage function and then translating this into value terms, or by determining the economic damage function directly by analyzing human activities. Most investigations have opted for the former. Statistical studies of the mortality/air pollution relationship and of the morbidity/air pollution relationship have various problems because air pollution is only one of many factors that might affect mortality or morbidity. In estimating morbidity costs, the parameters of environmental exposure, personal attributes, and socio-economic factors must be considered. The cost to human health in 1970 for both mortality and morbidity is estimated to be 1.6-7.6 billion dollars, with a best estimate of $4.6 billion. These estimates represent the range of benefits realized by reducing pollution to the national standards for particulates, sulfur dioxide, and sulfates. Dose-response, physical damage, and other functions should be improved to improve decision-making.

1973

34841 **APTIC NO. 57619**

Barthel, Yves, Pierre Bonnifay, Robert Dutriau, and Phillipe Renault

RELATIVE ECONOMICS OF RESID DESULFURIZATION VERSUS STACK GAS CLEANUP. *Inst. Francais du Petrole, Rueil-Malmaison, France, and Inst. Francais de Petrole, New York, 21p. (Also: Am. Inst. Chem. Engrs. J., 69(127):80-82, 1973.)*

Two IFP processes are described--one for hydrodesulfurization (HDS) of residual fuel oils, and one for removing sulfur dioxide from stack gases of oil-fired power plants. Typical economic studies are carried out for hydrodesulfurizing 2.5% sulfur-containing resid to give 0.3% sulfur fuel (New York City regulations for October, 1972). Studies are also carried out for power plants fired with resid containing 2.0%, 3.0% and 5.0% sulfur. Power plant output, above which stack gas cleanup is more economical than HDS (with or without blending), is 250 MW for fuels of 2.0%-4.0% sulfur for 200 ppm SO2 at the stack mouth. It pays to locate a large utility as close to its supply refinery as possible.

34842 **APTIC NO. 57528**

Nichols, Guy W.

A BUYER S VIEW OF THE RESIDUAL OIL MARKET IN THE YEARS AHEAD. *Am. Inst. Chem. Engrs. J., 69(127):159-160, 1973. (Presented at the American Institute of Chemical Engineers.)*

Approximately 75% of the U. S. residual requirements are imported primarily from Europe and the Caribbean. The electric utility market consumes 43% of the total U. S. annual requirement of 944 million barrels. This great utility demand has been brought about primarily by the environmental restrictions which have caused East Coast utilities to change from coal to oil. Environmental factors will continue to have a major impact on the supply/demand picture for residual oil over the next few years. Residual prices in general have been most volatile over the past two years. Unilateral action by host governments, transportation shortages, and the increased demands all served to put the oil market in general, and the residual market in particular, into a state of confusion. Development of the Alaskan and North Sea oil discoveries plus possible new discoveries will decrease both the United States and Europe s reliance on Mideast and African oil. Failing this or other new production, the currently producing countries will increase their take to the extent that residual prices will increase by 50% by 1980. It has been predicted that U. S. residual demand will be 1960 million barrels annually, with about 42% being consumed by electric utilities. The future of electric utility expansion is in nuclear generation.

34843 **APTIC NO. 57721**

Ridker, Ronald G.

TO GROW OR NOT TO GROW: THAT S NOT THE RELEVANT QUESTION. *Science, 182(4119):1315-1318, Dec. 28, 1973. 10 refs.*

The relevant question is not whether to limit economic growth or not, but rather how to channel and redirect economic output, and whatever increases in it come along, in ways that will make it better serve humanity s needs. A study on The Limits to Growth claims that population and economic growth must be stopped in the next several decades to avoid disaster within the next 100 years. However, the model used in Limits contains few of the important adjustment mechanisms that helped the world avoid similar catastrophies to date. The study incorporates highly pessimistic assumptions about technological progress, future reserves of nonrenewable resources, the ability to control and absorb pollution, and the extent of population growth. There is no scientific evidence for the functional relationships for pollution assumed in the model. Another study by the Resources for the Future for the Commission on Population Growth and the American Future reviews the prospects for more than 20 resources and 14 pollutants for the next 50 years. It states that if some costs are paid and some adjustments made, no catastrophies are likely to result from continued growth. The energy shortage is unlikely to be solely a consequence of population and economic growth, but is due to inappropriate policies and transitional problems of absorbing environmentalism into the set of shared public values. Pollution control costs are expected to increase from $8.5 billion in 1970 (in 1967 dollars) which is 1% of the GNP to $33.6-47.5 billion by 2000 which is still less than 2% of the GNP. The effect of various variables such as technological changes on pollution trends is discussed. However, the study of the Resources for the Future is limited because it deals only with 50 years and does not analyze all possible environmental threats.

1972

34844 **APTIC NO. 57613**

Commins (J. A.) and Associates, Inc., Fort Washington, Pa.

GROUP BUYING TO REDUCE AIR POLLUTION COSTS FOR SMALL PLANTS. *357p., Aug. 1972. 60 refs.*

A study of the utilization of group buying techniques together with better financing indicates that such an approach will ameliorate the pollution impact problem in the following ways: reduce investment by about 25%; reduce management time devoted to the problem; reduce technical and contractual risk by utilization of appropriate expertise; and reduce profit and cash flow binds by smaller investment needs, lower interest rates, and longer payback periods. Proper implementation would reduce, although not eliminate, the impact on small business as well. Data are presented for process variables, costs, and control specifications for the asphalt batching industry, the grain handling and milling industry, the gray iron foundry industry, the lime industry, and the secondary nonferrous metals industry.

1970

34845 **APTIC NO. 57247**

Cowherd, Chatten, Jr.

ECONOMIC EFFECTS OF AIR POLLUTION ON MATERIALS. *Missouri Univ., Columbia, Coll. of Engineering and Missouri Air Conservation Commission, Jefferson City, Proc. Air Pollut. Conf. Contr. Dusts, Smokes, Noxious Odors, 3rd Annu., 1970, p. C-1 to C-17. 5 refs. (Nov. 17.)*

The economic benefits derived from the control of air pollution may outweigh the costs incurred. While the costs of control programs and equipment are easily obtained, estimates of damage costs are more difficult to evaluate. The Midwest Research Institute estimated the total annual damage to materials by air pollution in a study of the soiling and deterioration of various materials. Deterioration decreases the economic value of a material by reducing its economic lifetime. Soiling causes increased cleaning costs. The rate of damage is a product of the value of the material and an interaction factor. One must distinguish between the in-place value and the value of service provided by the material. A list of just over 50 materials with about $50 million total U. S. annual production was compiled which make up about 40% of the total value of all materials. These materials were ranked according to the in-place value of the fraction of each material exposed to air pollution. The interaction factors for soiling and material are based on the increased cleaning frequency and the average fractional loss of useful life per year, respectively. Materials exposed to pollution were ranked according to the extent of soiling damage (primarily attributable to particulates) and to the extent of deterioration damage (primarily due to gases). The soiling of paint, zinc, and flat glass accounts for 80% of the damage. Total costs for soiling and deterioration are $100 billion and $3.8 billion, respectively. Paint and zinc account for over half the deterioration economic losses. These results are limited by available information. The anticipated yearly expenditures for air pollution control (about $7 billion for the next 5 years) are less than the estimated economic losses of more than $9 billion/yr for deterioration and many times that for soiling.

1968

34846 **APTIC NO. 57368**

Conner, J. M.

ECONOMICS OF SULFURIC ACID MANUFACTURE. *Chem. Eng. Progr., 64(11):59-65, Nov. 1968. 4 refs.*

Capital plant cost is divided between gas production, gas purification, and acid making. Except for very small plants, the cost of the raw materials is an overwhelming portion of the total production cost. Economies obtainable from plants with over 1000 tons/day outputs are very small. This is the result of a design approach in which the internal support structural problems of the required larger vessels and towers offset the cost advantages normally associated with increased size. All contact plants can be divided into acid making, gas purification, and gas production. The cost of the acid-making section depends on gas flow volume mainly on the gas volume being treated. Either factors increasing the cost of this section are the formation and disposal of weak acid and the necessity of recovering dust from the incoming gas. Gas for acid making can be generated primarily for the plant, or it can be a byproduct of another operation. The cost of gas production for acid making involves the raw materials, furnace, waste heat boilers, and associated equipment. When the gas is derived from another process, only the cost of connection to the plant is included. Plants utilizing waste sulfur dioxide gases can be designed to give partial, substantially complete, or complete conversion. In the light of air pollution, the latter two are more expensive but more desirable.

STANDARDS AND CRITERIA

1974

34847 **APTIC NO. 57519**

Boksleitner, Rudolph and John O Connor

CASE HISTORY OF THE USE OF CRITERIA AND EFFECTS DATA AS THE BASIS FOR DECISIONS ON THE CONTROL OF SULFUR DIOXIDE IN THE UNITED STATES. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., National Environmental Research Center, 25p., Jan. 3, 1974. 5 refs.*

A case history is presented on how criteria and effects data form the basis for decisions on the control of sulfur dioxide. The mechanism for implementing Federal standards is also presented. Legislation directing Federal action, selection of a control strategy, documentation of effects and control technology for air quality standards, the change from air air quality criteria to standards, and control decisions are described. Legislation directing Federal action includes the Clean Air Act Amendments of 1963, of 1967, and of 1970 which outline national air quality standards and control standards. Air quality criteria documents, legal requirements for control techniques, cost data documentation, risk philosophy used in developing criteria and standards, air quality standards for sulfur dioxide, and new source performance standards for SO2 for steam generating units and sulfuric acid plants are mentioned. Federal legislation provides for some regulation of air pollution at the national level, but most direct control is carried out by State and local governments. Although national air pollution control decisions are made by the Environmental Protection Agency in the final analysis, the public, independent groups of experts, and other Federal agencies do comment and make recommendations on basic data documentation and on proposed standards.

1973

34848 **APTIC NO. 57667**

Camner, Per, ed.

AIR QUALITY CRITERIA AND GUIDES FOR SWEDEN IN REGARD TO SULFUR DIOXIDE AND SUSPENDED PARTICULATES. *Nord. Hyg. Tidskr. (Stockholm), no. 5, 72p., 1973. 105 refs.*

Air quality criteria and guides for Sweden on sulfur dioxide and suspended particulates were evaluated. The Swedish Environmental Protection Board adopted the following standards for maximum ambient air concentrations of SO2: 5 pphm--monthly mean not to be exceeded; 10 pphm-24-hour mean, to be exceeded not more than once a month; and 25 pphm--1/2-hour mean to be exceeded not more than 1% of the time/mo. For suspended particles no corresponding standards exist in Sweden. An Air Quality Criteria Group was convened within the World Health Organization (WHO) to develop criteria and guides for oxides of sulfur, suspended particulates, carbon monoxide, oxidants, and oxides of nitrogen. The main emphasis was upon trying to find dose response relationships for SO2 and particulates and health effects, and on defining concentrations and exposure times which would not give rise to such effects. Only nonspecific particles were considered and not toxic substances. The goals concerning SO2 and smoke for air quality recommended by the WHO should be used as tools in the planning of air pollution control in Sweden. The physical and chemical behavior and methods of measurement of SO2 and suspended particulates are detailed. A brief description of the monitoring techniques as well as tables of observed levels of SO2 and particulate matter (soot and smoke) in Sweden is included. Epidemiology of pollution-related diseases are mentioned.

34849 **APTIC NO. 57771**

Kirk, Alan G., II

OFFICINE ALFIERI MASERATI S.P.A. ET AL. 1976 NITROGEN OXIDE STANDARD SUSPENSION REQUEST; NOTICE AND PROCEDURES FOR DISPOSITION. *Federal Register, 38(248):35528-35529, Dec. 28, 1973.*

The Clean Air Act provides that automobile manufacturers may file an application requesting suspension of the nitrogen oxide emission standard for light duty vehicles for one year. The Chrysler Corporation, Ford Motor Company, and General Motors were granted 1-year suspensions. The Officine Alfieri Maserati S.p.A. also filed for suspension.

34850 **APTIC NO. 57772**

Quarles, John

TEMPORARY EXEMPTIONS FROM AIRCRAFT EMISSION STANDARDS (FUEL VENTING AND SMOKE). *Federal Register, 38(245):35000-35001, Dec. 21, 1973.*

Although EPA aircraft emission standards prohibit fuel venting and regulate smoke, temporary exemptions from the venting and smoke standards may be granted to carriers using JT8D equipment if it has not been modified. Procedures for granting temporary exemptions are described.

1969

34851 **APTIC NO. 57558**

McKee, Herbert C. and Franklin W. Church

PARTICULATE STANDARDS KEYED TO VISIBILITY AND CITIZEN COMPLAINTS ARE INTERIM MEASURE. *Environ. Sci. Technol., 3(6):542, 546-548, June 1969.*

In the absence of a more rigorous definition, the term inert particulates has been used to designate particles with no readily identifiable toxic or reactive constituents. An ambient air standard is established on the basis of the lowest concentration and the shortest duration required to cause the adverse effects that must be limited, with due consideration for any local circumstances which would alter the values selected. Most of the existing air quality standards are based on one or more of three different methods of measurement: suspended particulates measured with a high-volume sampler; dust fall measured with a dust fall jar; and soiling index measured with a paper-tape sampler. In addition, California has a standard based on visibility. Despite differences in the method of measurement and in the statistical basis for expressing the standards, no major discrepancies appear in the various values which have been established. No standard appears to be either more or less restrictive than any of the others by a large margin. It would seem that most of the ambient air standards now in effect or recommended are reasonable in terms of the soiling and visibility effects.

LEGAL AND ADMINISTRATIVE

1974

34852 **APTIC NO. 57748**

Fishelson, Gideon

TAXING EMISSIONS: A THEORETICAL NOTE. *J. Air Pollution Control Assoc., 24(1):44-47, Jan. 1974. 10 refs.*

A theoretical proof for the nonoptimality of a uniform emission tax is presented. A method recently suggested for finding the optimal level of a uniform tax is criticized. An alternative tax system that could be either uniform or nonuniform that gradually increases over time is suggested instead. The feasibility and efficiency of the suggested tax are discussed on theoretical and empirical grounds. The suggested nonuniform tax rate of change over time, the time intervals, and the final tax (which should be an under-approximation of the optimal Pigouvian tax found for a uniform tax) should be specified ahead. The gradually increasing tax has many advantages including: giving observations on the reaction of the emitting sources to different tax levels; leaving sources enough time for planning their future behavior and adjustment ot the tax; adjustment costs would be relatively small and over-investment in equipment would be avoided; distortions in factor markets and inefficiency in production and resource utilization would be relatively insignificant; and both from the political and administrative costs points of view, the gradually increasing (decreasing) tax (quotas) are feasible and relatively inexpensive.

34853 **APTIC NO. 57736**

Meyers, Sheldon

ENVIRONMENTAL IMPACT STATEMENTS. AVAILABILITY OF COMMENTS AND OTHER ACTIONS IMPACTING THE ENVIRONMENT. *Federal Register, 39(3):1103-1105, Jan. 4, 1974.*

Comments have been made by the Environmental Protection Agency on Federal agency actions impacting the environment between Nov. 16, 1973 and Nov. 30, 1973. Draft and final environmental impact statements reviewed and commented upon in writing during this review period are listed. The list includes the Federal agency responsible for the statement, the number and title of the statement, the classification of the nature of EPA s comments, and the EPA source for copies of the comments. Definitions of the classifications of EPA s comments on the draft environmental impact statement are given. Proposed Federal agency regulations, proposed legislation, and any other proposed actions reviewed and commented upon pursuant to section 309(a) of the Clean Air Act, during the referenced reviewing period are listed. Names and addresses of sources for copies of EPA comments are listed.

34854 **APTIC NO. 57740**

Train, Russell

MASSACHUSETTS IMPLEMENTATION PLAN FOR THE METROPOLITAN BOSTON INTRASTATE AIR QUALITY CONTROL REGION. APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. *Federal Register, 39(3):1062, Jan. 4, 1974.*

A proposed revision to the Massachusetts implementation plan for the metropolitan Boston Intrastate Air Quality Control Region is described. The revision would revise the control of vapors from storage tanks and postpone the date of implementation of the ban on the utilization of residual fuel in 3-6 million Btu/hr facilities from July 1, 1973 to July 1, 1974. Person may submit written comments to the Regional Administrator of the Environmental Protection Agency in Boston.

34855 **APTIC NO. 57737**

Train, Russell E.

REVISED PARKING REVIEW REGULATION FOR THE CALIFORNIA TRANSPORTATION CONTROL PLAN. *Federal Register, 39(3):1025-1027, Jan. 4, 1974.*

The existing regulation providing for review of new parking facilities contained in the California transportation control plan is modified. Residential and religious organization lots have been exempted. The minimum size of parking lots to be reviewed has been increased from 50 to 250 spaces. The granting of permits has been revised. Management of the parking supply is discussed.

34856 **APTIC NO. 57738**

Train, Russell E.

APPROVAL OF PLAN REVISIONS: NEW JERSEY. APPROVAL OF PLAN REVISIONS: NEW YORK. *Federal Register, 39(6):1437-1431, Jan. 9, 1974.*

The need for revision of the New Jersey state implementation plan control strategy resulted from the inability of several large fuel oil suppliers to meet fully their commitments to provide fuel oil and to supply conforming fuel oil. As a result, a system of variance processing was set up and fuel standards were changed. Some plants were allowed to convert to coal. The New York state implementation plan was also revised to modify control of sulfur oxides. A temporary variance was granted to allow the use of residual oil with whatever sulfur content was currently available whenever sufficient supplies of low sulfur oil were not available. Several plants were also granted permission to burn coal. Reasons for these decisions, hearing, and potential impacts are discussed.

1973

34857 **APTIC NO. 56966**

Alsop, S. Reid

RECENT DEVELOPMENTS IN ENVIRONMENTAL LAW. *Highw. Res. Circ., no. 150:1-11, Nov. 1973. 28 refs.*

The National Environmental Policy Act (NEPA) has had a greater impact on the Federal aid highway program than any other environmental requirement. It requires that an environmental impact statement (EIS) be prepared with regard to every major Federal action. Several cases of litigation concerning the NEPA are discussed. Several plaintiffs have challenged the adequacy of the EIS prepared by Federal agencies. The major issue is whether a Federal court can engage in substantive review of an EIS that has been prepared in accordance with proper procedures. The Clean Air Act has set up air quality control regions, national air quality standards, and a program for the submission of implementation plans for each region. Several transportation control strategies have been proposed, including reducing total vehicle miles traveled, refitting vehicles with pollution control devices, imposing parking restrictions or exclusive bus lanes, improving traffic flow, rationing gasoline, and improving public transportation. Air quality standards are to be maintained. Highway projects must be consistent with the state implementation plans. The Land Use Policy and Planning Assistance Act and other environmental requirements also affect highway construction and increase the possibility of lawsuits.

34858 **APTIC NO. 57769**

Biczysko, J.

PROTECTION OF ENVIRONMENT AGAINST THE POLLUTION BY STEELWORKS IN THE LIGHT OF STUDIES CARRIED OUT IN THE INSTITUTE OF FERROUS METALLURGY. *(Ochrona srodowiska w hutnictwie w swietle prac wykonanych w Instytucie Metalurgii Zelaza im. St. Staszica). Text in Polish. Prace Inst. Hutniczych, vol. 25:109-117, 1973. 85 refs.*

Metallurgical processes cause pollution of the natural environment by poisoning water and air. Dust deposition, fumes, steelworks waste material, and noise are major problems. To study the problems of environmental pollution by the iron and steel industry on a wide scale, the Institute of Ferrous Metallurgy created the Department of Environmental Pollution Control. The department studies problems of water and waste treatment, neutralization of deposits, atmosphere protection, control of noise and vibration, and factors influencing the working conditions in steelworks. Some of the more important researches of the department are discussed.

34859 **APTIC NO. 57170**

Calder, K. L.

SUMMARY OF WORKSHOP DISCUSSIONS. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 4th Meet., Oberursel, West Germany, 1973, p. IV-1-IV-38. (May 28-30.)*

Presentations at the fourth Meeting of the Expert Panel on Air Pollution Modeling of the NATO Committee on the Challenges of Modern Society are summarized. The topics considered include: applications of models and users needs; validation of air quality simulation models; the role of regional air pollution studies in model development; the role of empirical/statistical modeling of air quality; and sophistication versus simplicity in air quality modeling.

34860 **APTIC NO. 57270**

Corley, J. P., D. A. Waite, J. W. Johnston, and L. C. Schwendiman

ENVIRONMENTAL SURVELLIANCE FOR FUEL FABRICATION PLANTS. *Battelle Memorial Inst., Richland, Wash., Pacific Northwest Labs., Atomic Energy Commission Contract AT(45-1):1830, 71p., April 1973. 70 refs.*

NTIS: BNWL-1723

An environmental surveillance program for air, water, and other media is presented for fuel fabrication plants; the program is sufficiently general to cover plants fabricating uranium oxide or mixed uranium and plutonium fuels and is not specific to a particular plant. It provides for surveillance of media believed either to be significant in terms of dose to man or to be potential centers for long-term accumulation of contaminants. Surveillance of the air is treated in terms of equipment and techniques for sampling, quality controls, and the potential for pollution from radionuclides, fluorine compounds, and nitrogen compounds. Regulations and standards for nuclear plants are discussed.

34861 **APTIC NO. 57395**

Erskine, G. and E. Jamgochian

MITRE TEST SUPPORT FOR THE CAT-OX DEMONSTRATION PROGRAM. *Mitre Corp., McLean, Va., Washington Operations, Environmental Protection Agency Contract, Rept. M73-50, 60p., May 1973.*

An outline is presented for the MITRE Catalytic-Oxidation Demonstration Program. The major task areas involved are: definition of test requirements; characterization of baseline performance in terms of operability, reliability, and emission levels prior to installation of the Cat-Ox process; determination of the relationship between control settings and operating conditions for the steam generator and flue gas properties at the Cat-Ox steam generator interface; and characterization of the emission control performance of the process in a One-Year Demonstration Test. Select test results are provided concerning: grain loading measurements, comparisons of continuous and manual measurements of sulfur dioxide with theoretical values, comparisons of continuous and manual measurements of oxides of nitrogen, sulfur balance measurements, and comparisons of coal and ash throughout the steam generator system. Key parameters were measured at three locations: prior to the economizer to provide data at relatively high temperatures corresponding to the inlet of an integral Cat-Ox system designed for installation in new steam generators; between the upper and lower sections of the air preheater, selected as representative of a lower temperature condition prior to any existing or planned flue gas treatment system; and mid-stack, approximately 135 ft above the foundation of the 250 ft stack to provide a condition representative of flue gas emitted to the atmosphere. Instrumentation and facilities for the measurement of gas concentrations, gas flow, and automatic recording of data are reviewed. (Author abstract modified)

34862 **APTIC NO. 57690**

Gleason, Jim and Bill Morin

THE COMMONWEALTH OF PENNSYLVANIA S STRATEGY FOR MEETING SECONDARY AIR QUALITY STANDARDS FOR PARTICULATES. (FINAL REPORT). *International Business Machines Corp., Gaithersburg, Md., Federal Systems Div., Environmental Protection Agency Contract 68-02-0043, Task Order No. 16, 552p., Nov. 15, 1973. 37 refs.*

The final report of Pennsylvania s strategy for meeting secondary air quality standards for particulates is presented. The prime objective of the task was to devise reasonable strategies for the control of particulate emissions to insure that air quality in the 1975-1980 time frame would meet the federal secondary standard for particulates, expressed as less than or equal to 60 micrograms/cu m. Major phases of the task included: compilation of an emissions inventory; collection of air quality, meteorological and demographic data; prediction of expected air quality in the 1975-80 time frame using an acceptable algorithm/model; and the development and testing of possible candidate control strategies which would insure acceptable air quality in the 1975-80 time period. Existing regulations, when fully enforced, were found adequate for meeting federal secondary standards in the Philadelphia area; while Pittsburgh will require that particulate emissions from coke operations be 90% controlled in order that the air quality standard be satisfied. (Author summary modified)

34863 **APTIC NO. 57691**

Gourdon, Francois

NOTES ON THE PROBLEMS OF POLLUTION AND ITS PREVENTION IN COMMUNIST CHINA. *(Republique Populaire de Chine. Notes sur les problemes de pollution et leur prevention). Text in French. Pollut. Atmos. (Paris), no. 59-304-311, July-Sept. 1973.*

Approaches to the problems of environmental protection in general, and of clean air maintenance in particular, in China are presented. Dispersion of industries to prevent emission concentration in specific areas, and the integral use of raw materials, products, and waste materials dominate the environmental policy adopted in China. Though air pollution due to industries is moderate because they are dispersed over vast areas, and nearly nonexistant due to automobile emissions, considerable efforts are being taken to improve the environment and the air quality. Emission control equipment excell by their simplicity. Flue gases from a chemical plant are cleaned of sulfur dioxide and dust by means of a simple washer that is claimed to have an efficiency of 90% for SO2. The responsibilities in environmental and pollution control areas are far from being coordinated, which makes duplication of effort unavoidable. Environmental subjects have been made part of the curricula at several colleges and universities. Forestation and the creation of green belts separating

34864 **APTIC NO. 57680**

Grundy, Richard D.

ELEMENTS OF AN ENVIRONMENTAL-ENERGY POLICY FOR THE SITING OF BULK ENERGY FACILITIES. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 28p., 1973. 13 refs. (Presented at the Air Pollution Control Association Annual Meeting, 66th, Chicago, Ill., June 24-28, 1973, Paper 73-54.)*

The need for a National Energy Policy which reflects regional, economic, social, and environmental impacts; incorporates the concept of technology assessment; provides for public participation in regulatory decisions; and provides for orderly and timely decisions on generic issues (such as energy demand and nuclear safety), is underlined in relation to finding new sites for electric power plants, refineries, synthetic fuel installations, deep water ports, and energy centers. Concerns of technology assessment must extend beyond the immediately obvious to consideration of the tradeoffs between various fuel cycles; and account must be given to the following: extraction of primary energy resources for the earth; preparation of these primary resources for use; conversion of primary resources to secondary resources; use of the resources; various transportation operations; and the recycling or disposing of waste by-products. Once a total fuel cycle has been appropriately delineated, it will then be possible to categorize the various factors affecting the siting of all or a given energy facility type.

34865 **APTIC NO. 57171**

Jones, Kay H.

INTRODUCTORY REMARKS TO WORKSHOP ON APPLICATIONS OF MODELING AND USERS NEEDS. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 4th Meet., Oberursel, West Germany, 1973, p. V-1-V-10. (May 28-30.)*

Goals and accomplishments are outlined for the work of the Expert Panel on Air Pollution Modeling of the NATO Committee on the Challenges of Modern Society. The project has been designed to promote air quality management programs; and its goals have included an assessment of ambient levels of pollutants, an inventory of sources and projected levels of air pollution in several major cities, selection of appropriate air quality models that relate emissions to ambient levels, assessment of the current state of the art in modeling, development of criteria documents that relate health and welfare effects to ambient concentrations, development of control technique documents that reflect the latest technology in the field, and the promotion of cooperation in research and development among member countries of NATO in the field of low pollution automotive power systems. Assessment studies concerning sulfur oxides, particulates, hydrocarbons, carbon monoxide, oxidants, and nitrogen oxides (stationary and mobile-source) have been completed for Ankara, Turkey, and St. Louis, Mo., with a Frankfurt report schedules for completion by fall, 1973.

34866 **APTIC NO. 57181**

Kwizak, M.

REAL-TIME METEOROLOGICAL PREDICTION IN SUPPORT OF AIR-QUALITY CONTROL OPERATIONS IN CANADA. *North Atlantic Treaty Organization, Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 4th Meet., Oberursel, West Germany, 1973, p. XVII-1-XVII-5. (May 28-30.)*

Routine meteorological forecast support as well as research and development programs of Canada s Atmospheric Environment Service are outlined in relation to air pollution episode control activities. The major air quality prediction support routinely available for the AES at the present time, aside from the prediction of standard meteorological variables (wind, temperature, stability), involves forecasts of so-called Stagnation and related Indices. These indices give a general qualitative indication of the ability of the atmosphere to move air pollutants vertically or horizontally from their source regions. The approach, however, is limited in that: the indices do not entirely relate to the physical processes involved in the movement of pollutants; the method does not give a quantitative measure of the ventilation capability of the atmosphere; and it does not take into account local variability due to terrain. Research and development projects currently underway to improve air pollution forecasting include: the development of a relative air-pollution potential index which is directly relatable to air pollution build-up for specified areas (100 km to a side); replacement of the indices with actual pollution predictions, pending the availability of pollution source parameters; introduction of terrain influences and special urban models for providing predictions down to a scale of 10 km; and systems to examine and predict the large-scale background pollution.

34867 **APTIC NO. 57681**

Nagda, Niren L. and Lyndon R. Babcock, Jr.

INTEGRATION OF LAND USE CONSIDERATIONS INTO AIR QUALITY MANAGEMENT STRATEGIES. *Preprint, 23p., Oct. 1973. 21 refs. (To be published in the Papers and Proceedings of the Regional Science Conference, 3rd, Honolulu, Hawaii, Aug. 1973.)*

Relationships between land use and air quality management strategies are presented. Selection of land use-related options will directly affect the amounts of air pollution produced, while land use patterns in combination with meteorological considerations will directly affect the air quality experienced by the receptors. The Air Quality-Land Use Manager (AQLUM) should weight emissions before using them to help define his air pollution problem, should have some urban geographic background before attempting to alter land use patterns, and should have a method for deciding how much money can be justified in order to achieve a given reduction in pollutants. The air quality management strategy must also be compatible with the fuel availability situation. Energy comparisons between modes must be combined with comparison of the index-weighted emissions on a vehicle-mile basis when transportation is being considered. Familiarity with the mechanisms of dispersion models and the principles of meteorology is also required. Combination of a dispersion model and a generalized urban model enables the prediction of air pollution consequences of different urban, energy use, and transportation patterns. Dispersion of a given population over a larger area usually results in a reduced per capita pollution effect, with the favorable effect diminishing as area increases and as non-transportation sources are more effectively controlled. Far greater air quality benefits are indicated by limiting city size (both population and area) and then nucleating new population centers when necessary.

34868 **APTIC NO. 57274**

Oynes, Chris C.

SUMMARY OF WORLD S ENVIRONMENTAL LAW: NATIONAL AND INTERNATIONAL AND MODEL NATIONAL ENVIRONMENTAL STATUTES: AIR, WATER, NOISE, AND WEATHER MODIFICATION. *Preprint, World Peace Through Law Center, Washington, D. C., 24p., 1973. (Presented at the Abidjan World Conference on World Peace Through Law, Aug. 26-31, 1973.)*

A compact overview of existing international and national laws governing environmental protection (air, water, noise, and weather modification) and a set of model national statutes for such protection are presented. A recent development of great significance has been the trend for a national law on air pollution control to contain references to, and guidance on, relations with and participation by, other nations. A model air pollution statute has been prepared to implement the provisions of the Draft Convention on Environment Cooperation Among Nations (1971) and contains 11 sections covering definitions, research and information, air quality criteria and control techniques, emission standards for stationary sources, concessions, fuel controls, federal works, international conferences, international liability study, cooperation with other levels of government, and judicial review and enforcement.

34869 **APTIC NO. 57731**

Quarles, John

CALIFORNIA TRANSPORTATION CONTROL PLAN. *Federal Register, 38(248):35467, Dec. 28, 1973.*

Compliance schedules for the establishment of bus/carpool lanes required by the California state implementation plan are now required by March 1, 1974 instead of Dec. 31, 1973.

34870 **APTIC NO. 57760**

Quarles, John

ENVIRONMENTAL PROTECTION AGENCY. (40 CFR PART 52). NEW JERSEY. UTAH. *Federal Register, 38(235):33775-33779, Dec. 7, 1973.*

A Notice of Proposed Rulemaking is issued for reconsideration and amendment of two regulations contained in the New Jersey transportation control plan promulgated by the Environmental Protection Agency on Nov. 13, 1973. The regulations concern employers charging a fee for parking for employees who drive to work alone and requiring EPA approval for the construction or modification of parking facilities. The approval and promulgation of the Utah implementation plan for implementation of national air quality standards required several smoke, plume, tracer, and diffusion studies to give information on sulfur dioxide concentrations. On the basis of these experiments and public hearings, the promulgated sulfur dioxide emission regulations were changed.

34871 **APTIC NO. 57763**

Quarles, John

APPROVAL AND PROMULGATION OF STATE IMPLEMENTATION PLANS. PROPOSED COMPLIANCE SCHEDULES FOR MISSISSIPPI. *Federal Register, 38(247):35325-35332, Dec. 27, 1973.*

Section 110 of the Clean Air Act, as amended, and the implementing regulations of 40 CFR Part 51 require that each State submit a plan which provides for the attainment and maintenance of the national ambient air quality standards throughout the state. Proposed revisions of the compliance schedule portion of the plan for Mississippi are listed which have been approved by the Environmental Protection Agency. The sources and their locations, the regulations involved, dates of adoption, effective dates, and final compliance dates are listed.

34872 APTIC NO. 57764

Quarles, John

PART 15–ADMINISTRATION OF THE CLEAN AIR ACT WITH RESPECT TO FEDERAL CONTRACTS, GRANTS, OR LOANS. *Federal Register, 38(247):35310-35313, Dec. 27, 1973.*

Comments are discussed which have been and have not been adopted by the Environmental Protection Agency with regard to the regulation policies and procedures to implement rules and regulations for Federal contracts, grants, and loans as provided for in the Clean Air Act. Comments were adopted concerning the effective date of program implementation, the definition of facility, the exemption for loans to assist a facility in complying with air standards, reporting of the compliance status, and list of violating facilities. Administrative requirements, administrative responsibility, definitions, agency responsibilities, exemptions, remedies (list of violating facilities, hearings, public participation, agency participation, investigation, and referral to the Justice Department), and ancillary matters (interpretations, reports, and delegation of authority by the Director) are described.

34873 APTIC NO. 57767

Quarles, John

CONTROL OF LEAD ADDITIVES IN GASOLINE. *Federal Register, 38(234):33734-33741, Dec. 6, 1973.*

Federal regulations to reduce lead additives in gasoline are described. Under the revised lead reduction schedule using total pool averaging, 1.7 g/gal lead is allowed in 1975, 1.4 g/gal in 1976, 1 g/gal in 1978, and 0.5 g/gal in 1979. The reproposed schedule was designed to accomplish a 60-65% reduction in lead usage from base 1971 by supplementing the projected increased use beginning in 1974 of lead-free gasoline by new automobiles with catalytic afterburners. The statutory basis for the regulations and the health issue are described. Lead from gasoline accounts for approximately 90% of the airborne lead, total lead additive usage being well over 200,000 tons/yr. Many persons have argued that airborne lead has not been proven to be a sufficient endangerment to health or a sufficient risk to the environment to warrant promulgation of controls. Therefore, the four major areas of criticism are discussed, and a summary of the significant new information received since the regulations were reproposed is given. These areas are the possible correlation between air lead levels and blood lead levels, the effect of dust lead on lead poisoning in children, the effect of a reduction of lead in gasoline on the incidence of clinical lead poisoning in children, and the possibility that lead in food and water and not airborne lead are the principal sources of lead to the general population. Other means of achieving lead reduction, the impact of increased use of aromatic hydrocarbons if low-lead fuel is used, particulate emissions from unleaded fuel, the use of substitute antiknock additives, cost and energy impacts, the effect on refiners, prevention of violations by refiners, and control of lead under Title I are also discussed.

34874 APTIC NO. 57583

Smith, Franklin and A. Carl Nelson, Jr.

GUIDELINES FOR DEVELOPMENT OF A QUALITY ASSURANCE PROGRAM. REFERENCE METHOD FOR THE DETERMINATION OF SULFUR DIOXIDE IN THE ATMOSPHERE. (INTERIM REPORT.) Research Triangle Inst., Research Triangle Park, N. C., Environmental Protection Agency Contract 68-02-0598, Proj. 43U-763, EPA-R4-73-028d, 134p., Aug. 1973. 9 refs.

NTIS: PB 226486/AS

Guidelines for the quality control of the Federal reference method for sulfur dioxide are presented. These include: good operating practices; directions on how to assess and qualify data; directions on identifying trouble and improving data quality; directions to permit design of auditing activities; and procedures for selecting action options and relating them to costs. The guidelines are designed for use by operating personnel. (Author abstract modified)

34875 APTIC NO. 57339

Sparling, Graham G.

THE EFFECT OF AUSTRALIAN EMISSION CONTROLS. *SAE-Australasia, 33(5):204-208, Sept.-Oct. 1973. (Presented at the Society of Automotive Engineers of Australia, National Convention, 73rd, Nov. 2, 1973, Paper 23.)*

Current and future exhaust emission regulations in Australia are surveyed and alternate approaches and problems are discussed. Australian vehicles will meet international standards for low idle emissions by 1974. Hydrocarbon vapors from the fuel tank will be controlled by 1975, and vehicles with lower exhaust emissions will be marketed i 1976 that will meet the United States 1973-1974 levels. The United States and European legislation that form the basis of controls for Australian vehicles are predicted soley on development evaluation. There are no plans to guarantee manufactured conformance or to police customer vehicles. Control legislation should aim to achieve idle test plus functional check of system control, multi-mode test involving specialized laboratory equipment and component inspection and functional test. Problems associated with achieving emission regulations include lack of adequately trained personnel, lack of adequate equipment, unkown requirements of the automotive industry, and the high financial cost of regulations.

34876 APTIC NO. 57702

Stern, Arthur C.

STRENGTHENING THE CLEAN AIR ACT. *J. Air Pollution Control Assoc., 23(12):1019-1022, Dec. 1973. 27 refs. (Presented at the National Conference on the Clean Air Act, Chapel Hill, N. C., Oct. 31-Nov. 1, 1973.)*

Several flaws in the Clean Air Act include the dubious basis for motor vehicle emission standards; the ambiguity of the language describing the purpose of the act; the sections involving air quality standards with regard to inclusion of dual standards, exclusion of regional standards, and disregard of state standards; reassessment of mandated time schedules; more flexibility to remove the rigid delineation of air quality control regions mandated by the act; built-in deterrents in the act which hinder accurate setting of emission standards for certain toxic substances; and fiscal provisions which need reworking.

34877 APTIC NO. 57625

Talley, William Woodrow, II.

MANERGY: AN ENERGY MANAGEMENT MODEL OF THE UNITED STATES FOR THE PREDICTION OF ENERGY DEMAND, RESOURCE CONSUMPTION, ENVIRONMENTAL EFFECTS, THE ASSESSMENT OF NEW TECHNOLOGY, AND ENERGY RESOURCE ALTERNATIVES. *Oklahoma Univ., Norman, Okla., Dept. of General Engineering, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1973, 725p. 94 refs.*

A computerized, systems-analysis model of the United States energy system has been developed and presented in code form. The model was designed for use as a management tool for assessing the consequences of resource and fuel alternatives, environmental controls, and technological advances. The assessment guidelines have been presented as resource consumptions, environmental impacts, and balance of payment deficits to the year 2100. The model s capabilities and its inherent flexibility have been demonstrated for a baseline case and several alternatives. The basic case consists of on current energy use patterns, diversified resource development, projected fuel splits, population and gross national product projections, and reasonable advances in technology. The model has shown sufficient flexibility to include the results of many existing and future studies on energy supply and demand and has quantified the impacts of energy policy decisions into acceptable indices. (Author abstract modified)

34878 **APTIC NO. 57739**

Train, Russell E.

ELECTROBUS DIVISION OF TORK-LINK CORP. LOW-EMISSION VEHICLE NOTICE OF DETERMINATION. *Federal Register, 38(235):3396, Dec. 7, 1973.*

The Environmental Protection Agency has recommended to the Low- Emission Vehicle Certification Board that a battery-powered bus be certified as an inherently low-polluting vehicle according to the criteria specified in the Clean Air Act.

34879 **APTIC NO. 56987**

Japan Chamber of Commerce, Tokyo, Bureau of Industrial Pollution Information

REPORT ON ACTIVITIES OF BUREAU OF INDUSTRIAL POLLUTION INFORMATION, JULY 1973. *(Sangyo kogai sodanshitsu jigyo hokokusho, Showa 48-nen 7-gatsu bun). Text in Japanese. 45p., July 1973.*

The branch bureaus of the Industrial Pollution Information Department of the Japan Chamber of Commerce throughout Japan counseled 901 cases in July 1973, 134 of which were on air pollution and 26 on bad odor. For air pollution, 55 were on technical matters, 36 on legal, 13 financial, four on tax, one on moving a plant site, 16 on control equipment and nine on miscellaneous; for bad odor, 13 were on technical matters, five on legal, two on financial, one on tax, one on relocation, three on control equipment, and one on miscellaneous. The most active branch was Osaka, receiving 16 consultations. Some of the contents were: the treatment of aluminum dusts in the flue gas in the process of alminum ingot producing; the treatment of black smoke from incineration of ink manufacturing waste oil, the possibility of the use of high sulfur oil for incineration of chicken excreta; treatment of nitrogen oxides for low temperature LPG gas furnace; dust collection for cupola, and desulfurization of boiler stack gas.

34880 **APTIC NO. 56988**

Japan Chamber of Commerce, Tokyo, Bureau of Industrial Pollution Information

REPORT ON ACTIVITIES OF BUREAU OF INDUSTRIAL POLLUTION INFORMATION, AUGUST 1973. *(Sangyo kogai sodanshitsu jigyo hokokusho, Showa 48-nen 8-gatsu bun). Text in Japanese. 28p., Aug. 1973.*

The Bureaus of Industrial Pollution Information throughout Japan, gave a total of 825 consultations in August 1973, 108 of which were on air pollution. The content of counseling were: 30 technical matters, 44 legal matters, six financial, three tax, one on moving a plant site, one on pollution control equipment, and 14 miscellaneous matters. Osaka was the most active branch bureau and handled 16 cases, of which 10 were concerned with legal matters. On technical matters, the treatment of plastic steam produced by polyvinyl chloride foaming process, the treatment method for mist and gas produced in the process of alumite coating, and the treatment of hydrogen sulfide in chemical industry were some of the counselings given. There were 38 cases concerning bad odor, of which 18 were technical, 10 legal, 5 financial, one on tax, two on control equipment, and two on miscellaneous matters.

34881 **APTIC NO. 57398**

Copley International Corp., La Jolla, Calif.

A STUDY OF THE SOCIAL AND ECONOMIC IMPACT OF ODORS. PHASE III. DEVELOPMENT AND EVALUATION OF A MODEL ODOR CONTROL ORDINANCE. (FINAL REPORT). *Environmental Protection Agency Contract 68-02-0095, Rept. EPA-650/5-73-001, 229p., Feb. 1973. 21 refs.*

NTIS: PB 223589/AS

An attempt was made to prepare a model odor control ordinance that could be adopted and applied effectively by enforcement authorities throughout the United States. The following tasks were undertaken: preparation of a tentative form of the model ordinance; selection of four air pollution control agencies to evaluate the procedures developed in the second phase of research along with the model ordinance; instruction of employees of the selected agencies in the proper use of the procedures in relation to the model ordinance; guidance of selected agencies project related field activities; and refinement of the procedures and the model ordinance for submission to the Environmental Protection Agency. A public attitude survey was taken. A model ordinance cannot be drafted that is compatible with the legalistic approach to controlling air pollution preferred by every jurisdiction. Emphasis has thus been given to a conceptual framework in the development of the model ordinance that would promote the most efficient solutions to community odor problems given the existing state of knowledge. The procedures for identification and assessment of community odor problems are described, including a questionnaire for an opinion survey. Odor control regulations for 203 state and local agencies are summarized.

34882 **APTIC NO. 57399**

Council on Environmental Quality, Washington, D. C.

ENVIRONMENTAL QUALITY: FOURTH ANNUAL REPORT. *533p., Sept. 1973. 680 refs.*

GPO

The fourth annual report of the Council on Environmental Quality is presented. Efforts to make cities better places to live, work, and visit are described and elements that lead to vitality and diversity in downtown areas and in urban neighborhoods are identified. The relationship between economics and the shaping and implementing of environmental policy is explored through the four types of environmental costs, abatement, avoidance, transaction, and damage. The implications of the taking clause of the fifth amendment to the U. S. Constitution is discussed as it applies to land use regulation by state and local governments to protect environmentally critical features of land. Major developments in the past year in government programs to protect the environment are reviewed. Information on status and trends in environmental quality and current conditions for air pollution, water pollution, land use, solid waste, and population is presented. International environmental accomplishments of the past year are reviewed in a historical perspective and include oceans, transboundary pollution, and preservation of wildlife and natural areas. The environmental movement as it is constituted today--the variety of environmental organization, their interests and activities, their resources, and their problems are discussed. Air quality standards and the Clean Air Act are discussed. Emissions standards, urban air pollution episodes, and emission levels are reviewed.

34883 **APTIC NO. 57666**

Environmental Protection Agency, Cincinnati, Ohio, National Environmental Research Center

NATIONAL ENVIRONMENTAL INFORMATION SYMPOSIUM: SUMMARY REPORT, VOLUME I. *47p., May 1973.*

The role of information technology in local, state, and Federal environmental programs was discussed at the National Environmental Information Symposium in September 1972. The symposium was divided into five user panels which brought together representatives of the major interest groups active in environmental affairs. These panels reported on the following groups in terms of their role in information dissemination and utilization: citizens action; the press and publications; industry and trade associations; academic, research organizations, and professional societies; and government. Environmental information should be more readily available to those who want it, and there is a need for greater awareness of the availability of such information. Information should be specifically packaged for various user groups or presented in language understandable to all. There is a need for environmentally-oriented national information facilities and services, and a national program is necessary to coordinate efforts to handle and disseminate environmental information. Referral activities may be the single most important element in the transfer of vital and timely environmental information. Follow-up activities to the symposium should continue at the Federal, state, and regional levels. Appended are a list of exhibitors, speakers, committees, and moderators. Volume II (Proceedings) includes papers, introductory statements, and reports.

1972

34884 APTIC NO. 57320

Rodi, Dieter

ENVIRONMENTAL PROTECTION IN RESEARCH AND EDUCATION IN BIOLOGY DEPARTMENTS OF TEACHERS TRAINING COLLEGES. *(Umweltschutz in Forschung und Lehre im Bereich der Biologie an Paedagogischen Hochschulen). Text in German. Society for Ecology, Proc. Conf. Load Loadability Ecosystems, Giessen, West Germany, 1972, p. 207-210. 5 refs.*

The study of environmental protection-related problems along with their scientific and didactic aspects in the Biology Department of the Schwaebisch Gmuend Teachers Training College is described. Environmental and ecologic aspects are emphasized in the curricula in all biological fields, and didactically oriented function models of waste disposal, drinking water supply, pesticides residues, and air pollution are developed. The didactic approaches to ecologic problems are tested beforehand in high schools. Post-graduate courses are held regularly for practicing teachers.

34885 APTIC NO. 57494

Enviromental Protection Agency, Washington, D. C., Div. of Intergovernmental Relations

COMPENDIUM OF STATE AIR POLLUTION CONTROL AGENCIES FOR 1972. *Rept. APTD-1556, 374p., Sept. 1, 1972.*

NTIS: PB 224572/AS

A compendium of State Air Pollution Control Agencies has been prepared by the Environmental Protection Agency to provide State and local governments, non-government entities, and others interested in air pollution control programs with summaries of the statutory, organizational, and functional means adopted by the States, territories, and possessions of the United States to achieve environmental goals in the area of air pollution control. Principal information sources used included: State codes and session laws, State air implementation plans filed with EPA, and information supplied by EPA regional offices. The compendium identifies the principal policy-making and regulatory organizations responsible for air pollution control in each state, the District of Columbia, Guam, American Samoa, Puerto Rico, and the Virgin Islands. The organizational structure of these agencies and their relationship to other State agencies are described diagrammatically. General statutory references to the States basic air pollution control laws as well as specific references to particular powers and authorities are also provided.

1971

34886 APTIC NO. 57219

Brogan, John J.

THE ADVANCED AUTOMOTIVE POWER SYSTEMS PROGRAM. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Conf. Low Pollut. Power Syst. Dev., Eindhoven, Netherlands, 1971, p. III-1-III-27. (Feb. 23-25.)*

The Advanced Automotive Power Systems Program, consisting of a Federal research and development program and an industrial Clean Car Incentive Program, has as its goal the development of a virtually pollution-free power system for automobiles by 1975. Candidates for development in the research program include: the gas turbine, the heat engine/electric, the heat engine/flywheel, Rankine cycle power plants, the all-electric system, the stratified charge engine, and the diesel engine; particular versions of the last two systems are reasonably well-developed and are being considered as candidates because of their nearer term potential for meeting the 1975/76 emission standards when mass produced. Both programs are open to firms residing outside of the United States.

34887 APTIC NO. 57218

Shizume, Mr.

RESEARCH AND DEVELOPMENT PLAN OF ELECTRIC CAR. *North Atlantic Treaty Organization Committee on the Challenges of Modern Society, Proc. Conf. Low Pollut. Power Syst. Dev., Einhoven, Netherlands, 1971, p. XIV-1-XIV-6. (Feb. 23-25.)*

A general scheme is presented for the development of a Japanese electric car by 1975 for the purpose of minimizing vehicular air pollution. Total development cost is estimated at about $13 million. A primary experimental electric car will be produced and tested for performance and safety during the first three years of the project (beginning in 1971) and will then be judged according to its social and economic feasibility. Research and development focus will be placed upon such components as a lead lead oxide battery, a new type of battery, a new type of motor (thyristor motor, wheel motor), a controller, and a plastic body. Specification and performance criteria are tabulated for small scale and medium-scale cargo cars, small- and medium-scale passenger cars, and large-scale buses.

1970

34888 APTIC NO. 57404

Sauter, George D. and Ernest G. Chilton

AIR IMPROVEMENT RECOMMENDATIONS FOR THE SAN FRANCISCO BAY AREA. (FINAL REPORT). *Stanford Univ., Calif., School of Engineering, NASA Contract NGR-05-020-409, 279p., Oct. 1970. 24 refs.*

The air pollution problem in the San Francisco Bay Area was investigated, and suggestions and recommendations for handling the problem are delineated. Topics covered include: the present Bay Area air pollution situation; present control programs and resulting pollution trends; an ideal air pollution surveillance system; existing data collection systems; an improved data collection system; modeling air pollution; recommendations for the Bay Area air pollution control district; and long-range strategies for the control of air pollution. Appendices contain information on: air quality criteria, a program for the long-range prediction of pollutant emissions from automobiles, automotive air pollution sources, air quality indices, Puget Sound District emission inventory, details from emission reports on violators, riding shotgun with inspectors, a test of line-integrated ambient air pollution detection, cost for an experimental mobile station, recommendation for an episode warning system, Ringelmann alternative, the meteorology of the Bay Area and its effect on the air pollution problem, an atmospheric photochemical reaction model, a description of proposed source inventory masterfile records, the problem of the curious and concerned citizen, automobile inspection, a proposed measure of effectiveness, and a proposal for emission regulations based upon air cell and air shed capacity.

1969

34889 **APTIC NO. 57221**

Engebretson, Gordon R.

MEDICINE AND ENVIRONMENTAL HEALTH. *Calif. Med., 110(2):125-129, Feb. 1969. (Presented at the California Medical Association, Annual Session, 97th, San Francisco, March 23-27, 1968.)*

The Task Force on Environmental Health and Related Problems studied methods of protecting man from the threats of environmental damage to health. Some important recommendations were that Health, Education, and Welfare require the reduction of stack emissions by 90% in 1970, and that national standards be established for the reduction of vehicle exhaust emissions by 90% from 1967 levels. Also recommended was that the Department seek authority to provide air pollution program grants only to those control agencies which develop emergency plans that would control combustion activities under air pollution alert conditions.

34890 **APTIC NO. 57162**

Gaessler, Willi

WHAT DOES ONE DEMAND OF INDUSTRY IN WESTERN EUROPE FOR THE MAINTENANCE OF WATER AND AIR PURITY? (Was fordert man in Westeuropa im Interesse der Reinerhaltung von Wasser und Luft von der Industrie)? Text in German. Wasser Luft Betrieb, 13(3):96-100, March 1969.

Legal and administrative measures for water and air pollution control in West European countries are surveyed. Equivocal traditional anti-pollution laws have been slowly superseded by highly specific regulations, guide-lines, and recommendations. The exemplary Technical Guide to Clean Air Maintenance issued Sept. 8, 1964 by the German Federal Government is briefly reviewed. One significant feature of it is that a permit to build and operate a plant is issued or renewed only if plans provide for the currently most effective equipment for limitation and dispersion of emissions.

GENERAL

1973

34891 **APTIC NO. 57295**

Syrota, J.

WAR IN AIR POLLUTION. A STATE-OF-THE-ART REPORT? (La lutte contre la pollution atmospherique. Ou en est-on)? Text in French. Tech. Moderne, no. 9:17-22, Sept. 1973.

A state-of-the-art report of the general air pollution situation, and of air pollution control measures taken or envisaged in France is given. In Paris, the sulfur dioxide concentrations have declined considerably from 195 micrograms/cu m in 1962-1963 to 121 micrograms/cu m in 1969-1970, while the black smoke level has abated from 94 micrograms/cu m in 1962-1963 to 58 micrograms/cu m in 1966-1967. The recent increase in the SO2 concentrations has been due to the limited availability of low-sulfur fuel oil and unfavorable meteorological conditions. The traffic-generated carbon monoxide concentrations has abated from 21 ppm in 1962 to 15 ppm in 1970. While dust control is relatively easy by modern dust separators or by technological changes, odor control remains a problem. The abatement of the SO2 emissions will require rather expensive desulfurization of the fuels, or flue gas desulfurization. Air quality monitoring and air pollution warning system, integrated in a central data processing unit, will be set up with stations in the highly industrialized and densely populated areas. The air pollution control politics will be based upon the polluter-must-pay principle, and also state subsidies and aids will be granted to encourage air pollution control-related investments.

1972

34892 **APTIC NO. 57513**

Banhegyi, Matyas, Lajos Csatai, and Ferenc Gacs

PROBLEMS OF HUMAN ECOLOGY AS REFLECTED BY THE SITUATION OF URBAN HYGIENE IN BUDAPEST. *(A human okologia kerdesei a fovaros telepulesegeszsegugyi helyzetenek tukreben). Text in Hungarian. Budapesti Kozegeszsegugy, no. 2:36-37, 1972. 7 refs.*

General problems of air pollution, water pollution, and drinking water supply in Budapest are outlined. The sulfur pollution has decreased from 1963 to 1969 by about 30%, due to the use of less-polluting energy carriers in different industries and to the shutdown of several, mostly obsolete, plants in Budapest. Domestic heating continues to be chiefly responsible for air pollution. Despite the rapid increase in the number of vehicles, air pollution due to automotive exhaust is not a serious problem even under unfavorable meteorological conditions. A recently adopted general city development plan envisages the segregation of industrial from residential areas, and the creation of green belts and parks.

34893 **APTIC NO. 57302**

Malmer, Nils

SOCIAL DEVELOPMENT AND THE ENVIRONMENTAL LOAD OF ECOSYSTEMS IN SOUTHERN SWEDEN. *(Gesellschaftsentwicklung und Belastung von suedschwedischen Oekosystemen). Text in German. Society for Ecology, Proc. Conf. Load Loadability Ecosystems, Giessen, West Germany, 1972, p. 109-114. 5 refs.*

Problems of the environmental load of ecosystems in southern Sweden, conditioned by social and technological developments, are discussed. Some 80% of the total ion load of surface waters in southern Sweden are of atmospheric origin. The conductivity and the sulfate content of surface waters in the Ancholm area have increased by about 20% and by 50 micromol, respectively, during the last 10 years, a change parallel to a strong reduction in the dicarbonate level. These changes are attributed to the increased sulfuric acid content of rainwater due to the washout of sulfur dioxide of continental and west-european origin. The highest lead contents in plant materials were detected in specimens of Hylocomium splendens growing in sparsely populated regions along the western coast, indicating entrainment from remote sources. The forest production losses due to SO2 damages in Sweden are estimated at at least $100,000,000.

34894 **APTIC NO. 57301**

Mueller, Paul

PROBLEMS OF THE ECOSYSTEM OF AN INDUSTRIAL CITY, AS EXEMPLIFIED BY A SAARBRUECKEN. *(Probleme des Oekosystems einer Industriestadt, dargestellt am Beispiel von Saarbruecken). Text in German. Society for Ecology, Proc. Conf. Load Loadability Ecosystems, Giessen, West Germany, 1972, p. 123-132. 29 refs.*

A complex study of the ecosystem of Saarbruecken, an industrialized city in West Germany, is outlined. The mean temperature in the city was 1.7 C higher than the ambient temperature. The natural cold air basins over the city, essential for the vertical ventilation especially in inversion periods, have been more or less destroyed by high buildings. Lichen surveys determined lichen deserts in zones in which sulfur dioxide concentrations higher than 0.13 mg/cu m were measured. The complex ecologic survey is being completed with SO2, carbon monoxide, and dustfall measurements, as well as with geomedical surveys on the occurrence and distribution of allergies and lung diseases.

1939

34895 **APTIC NO. 57635**

Drinker, Philip

ATMOSPHERIC POLLUTION. *Ind. Eng. Chem., 31(11):1316-1320, 1939. 20 refs.*

Any unusual concentration of any substance in the atmosphere signifies pollution. Concentrations of pollutants range from grams per liter to micrograms per cubic meter. The polluting agent may be harmful to animals or plants, it may be detrimental to machinery, or it may be merely a nuisance. Pollution may be caused by industrial fogs or mists but it may also result from natural phenomena such as fogs, volcanoes, or dust storms. However, atmospheric pollution is usually man-made. The most common polluting agent is carbon from incomplete combustion. The most important gaseous contaminants are the sulfur gases. Sulfur dioxide is irrespirable by man in toxic concentrations, but plants are generally damaged by continuous exposure to concentrations above 1 ppm. The usual method of sulfur dioxide control is to build a stack of sufficient height to allow dissipation of the gases, but washing procedures are also used. Other toxic sulfur gas pollutants are hydrogen sulfide and carbon disulfide. The mercaptans and carbon disulfide can be eliminated best if they are first oxidized to sulfur dioxide. Carbon monoxide, which is emitted primarily in automotive exhaust, is another common pollutant.

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